LOCK ON N°13

AIRCRAFT PHOTO FILE

670

AH-64A APACHE

ATTACK HELICOPTER

Willy PEETERS

Foreword by Ltc Patrick J. SHEAHAN
Commander 3 BN/227AVN

VERLINDEN PUBLICATIONS

AH-64A APACHE
3/227th AVIATION REGIMENT
U.S. ARMY, HANAU ARMY AIRFIELD

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Front cover: AH-64A APACHE with a full load of rockets, Hellfire missiles and 30mm gun ammo, flown by the "front seater" on a practice mission in Saudi Arabia. Pilot CW2 Alvin "Big Al" ANDERSON monitoring the flight from the back seat with CPG CW2 Art "Shell" GRIBENSK at the controls.
(Photo by WO1 David NUSS, A Co 3/227 AHB)

Title page: AH-64A APACHE of the 3/227th Aviation Regiment outside one of the maintence hangars at its home base, Hanau Army Airfield in Germany.

Page 3: A string of 30mm shell casings drop from this AH-64A chain gun at a range in Saudi Arabia, only weeks before going into action. This APACHE is loaded in the "heavy" configuration of 16 Hellfire missiles.
Pilot is known to be CW2 George WALKUP while no info existed on the CPG.
(Photo by WO1 David NUSS, A Co 3/227 AHB)

Rear cover: One of the key players in the Gulf War, loaded for another mission. The hostile desert environment caused heavy weathering on the matt paint which not only absorbed radar waves but a lot of desert dirt.
"Nose art" was almost exclusively applied to the fairings rather than the fuselage nose section.
Many different decorations emerged, some as explicit as this one.
(Photos via Capt. Peyton RANDOLPH)

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To Ltc Patrick J. SHEAHAN, commander, and Capt Scott B. THOMPSON (who also forwarded some photos of Gulf War engagements) of the 3/227th AVN for taking time out of their busy schedule and providing me the opportunity to take photographs in their unit.
To all the men, pilots, crewchiefs and maintenance personnel of the "Bounty Hunters" at Hanau Army Airfield, especially SPC George S. HOMICH III, for their assistance and for tolerating the presence of this photographer.
To Capt Peyton RANDOLPH and his spouse for providing some of the Gulf War pictures which make this book so much more interesting.

Finally, my most sincere thanks to my dear friend CW4 Greg Cain for arranging the visit and to his spouse Mary for their wonderful hospitality during my stay.

To those I skipped to mention, please do not feel offended, it was not my intention.

The author

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Readers are invited to send in slides and/or clear color photographs on military subjects which may be used in future LOCK ON publications. Additional information on military aircraft of any kind is also welcomed. Material used will be paid for upon publication and unused material will be returned upon request. Original slides and photographs will be handled with extreme care.
Clearly state name and address when sending in your material.

Forward

The AH-64A APACHE is without question the finest attack helicopter in the world today ! It has proven itself in the deserts of Iraq to be a robust and lethal weapons system.
With its combination of Hellfire anti-tank missiles, 70mm rockets and the 30mm chain gun coupled with its day/night fighting capabilities, it is a force to be reckoned with on todays battlefield. The APACHE was responsible for destroying more enemy armored vehicles during the Iraqi war than all other weapon systems in both the Army and Air Force combined.

The AH-64 carries a crew of two. The pilot in command usually occupies the rear seat while the front seat is the copilot/gunner position (CPG); however, all weapons systems can be fired from either position. The APACHE is powered by two General Electric 701 turbine engines, each rated at 1,690 shaft horsepower. The aircraft is fully aerobatic and is equipped with a full aircraft survivability suite. This includes a radar jammer, a radar warning receiver, an infra-red jammer and a chaff/flare dispenser.

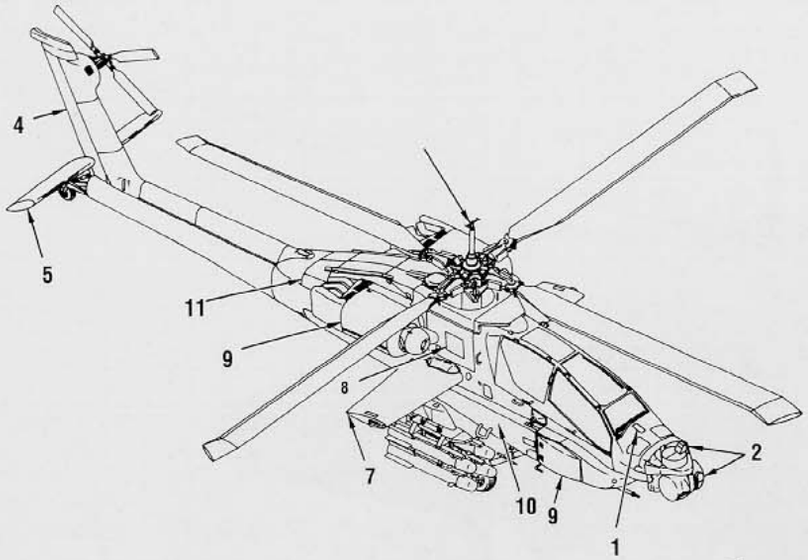
At present the AH-64A is the only model of the APACHE in service with the Army; although the Army will soon be taking delivery of the more modern AH-64 (LONGBOW) to ensure the AH-64 remains the deadliest attack helicopter in the world in defense of world peace.

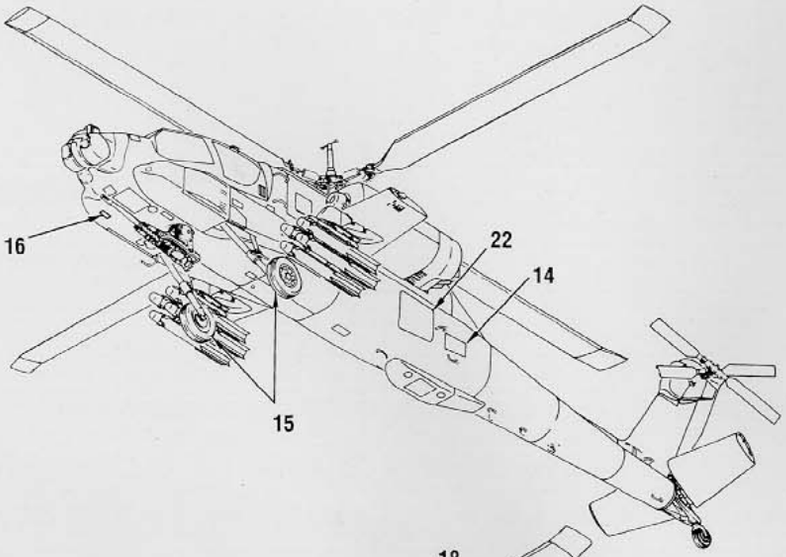
LTC Patrick J.SHEAHAN
Commander 3rd BN/227 AVN

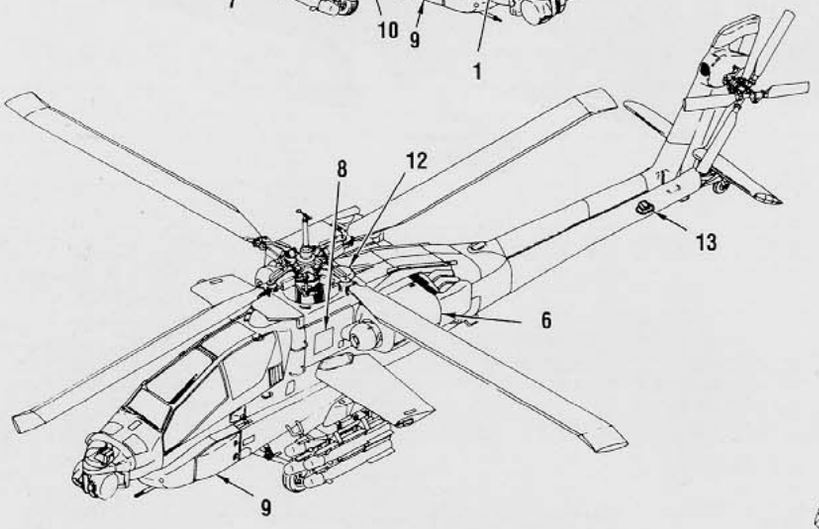
CPT Scott B.THOMPSON
Battalion Intelligence Officer

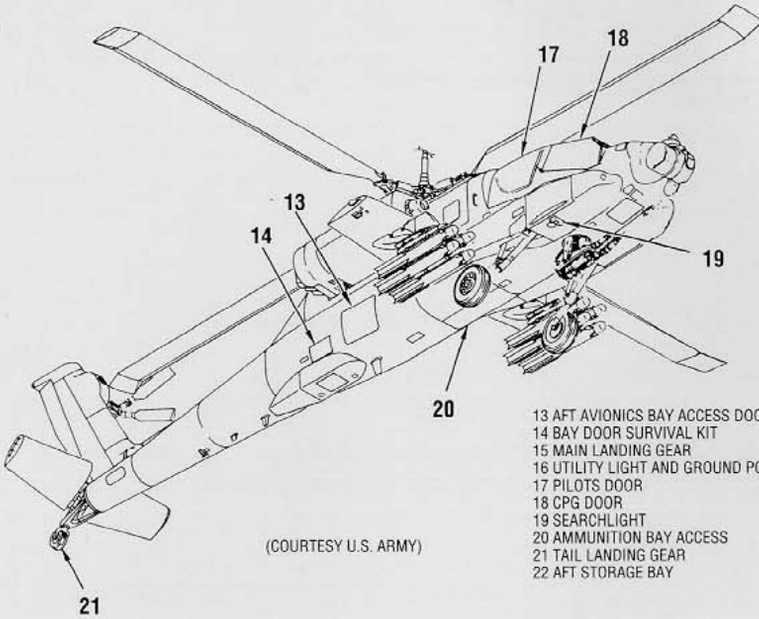
Hanau Army Airfield, Germany

GENERAL ARRANGEMENTS







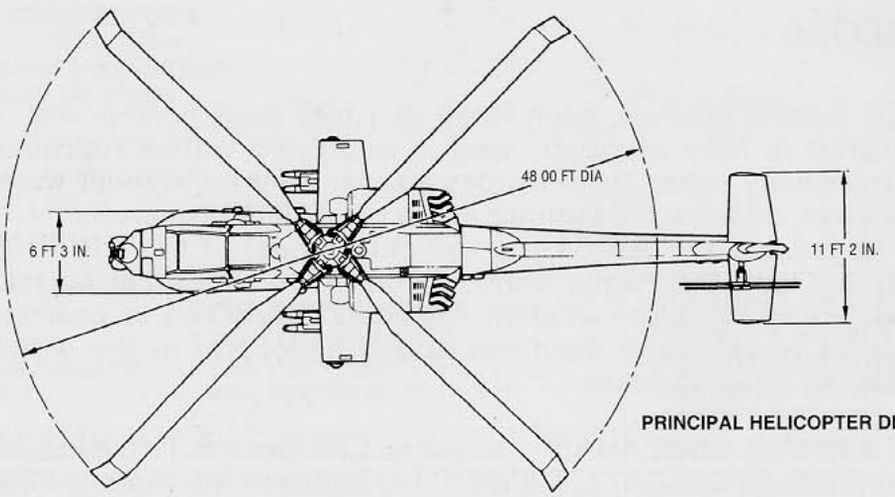


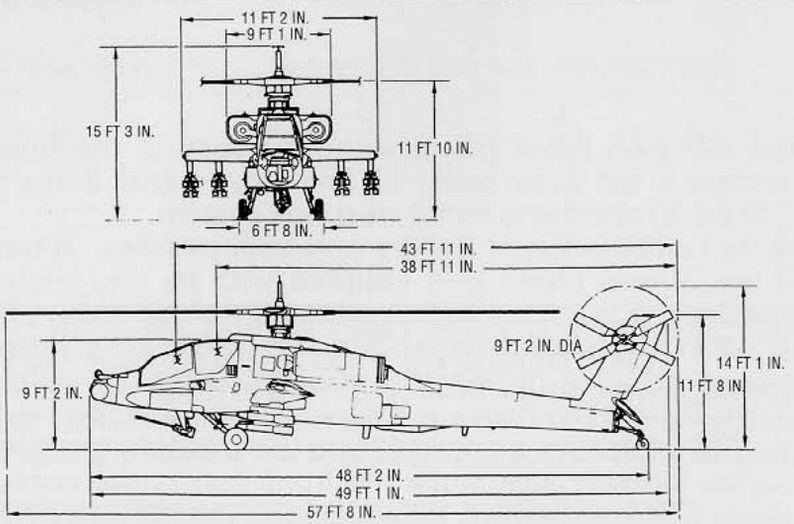
1 CANOPY JETTISON HANDLE ACCESS DOOR
2 TADS-PNVS TURRET
3 AIR DATA SENSOR
4 VERTICAL STABILIZER
5 STABILATOR
6 NACELLE DOOR ASSEMBLY
7 INTERCOMUNICATIONS ACCES DOOR
8 TRANSMISSION ACCES DOOR
9 FORWARD AVIONICS BAY ACCESS DOOR
10 FIRE EXTINGUISHER ACCESS DOOR
11 HYDRAULIC GROUND SERVICE PANEL ACCESS DOOR
12 INFRA RED COUNTER MEASURE DEVICE MOUNT
13 CHAFF PAYLOAD MODULE

(COURTESY U.S. ARMY)

13 AFT AVIONICS BAY ACCESS DOOR
14 BAY DOOR SURVIVAL KIT
15 MAIN LANDING GEAR
16 UTILITY LIGHT AND GROUND POWER OUTLET ACCESS DOOR
17 PILOTS DOOR
18 CPG DOOR
19 SEARCHLIGHT
20 AMMUNITION BAY ACCESS
21 TAIL LANDING GEAR
22 AFT STORAGE BAY

PRINCIPAL HELICOPTER DIMENSIONS




11 FT 2 IN.
9 FT 1 IN.
15 FT 3 IN.
11 FT 10 IN.
6 FT 8 IN.
43 FT 11 IN.
38 FT 11 IN.
9 FT 2 IN. DIA
14 FT 1 IN.
11 FT 8 IN.
9 FT 2 IN.
48 FT 2 IN.
49 FT 1 IN.
57 FT 8 IN.

3rd BATTALION, 227th AVIATION REGIMENT

The 3rd Battalion, 227th Aviation Regiment was constituted on 1 February 1963 as Company C, 227th Assault Helicopter Battalion and assigned to the 11th Air Assault Division, Fort Benning, Georgia. On 1 July 1965 the battalion was reorganized and relieved from assignment from the 11th Air Assault Division and reassigned to the 1st Cavalry Division (AIRMOBILE). The battalion deployed to Vietnam in September 1965 and served with distinction from October 1965 through August 1971. It redeployed back to Fort Hood, Texas and inactivated in November of 1974. The battalion was again reactivated in May 1978 as part of the 1st Cavalry Division.

Finally, after almost 20 years with the 1st Cavalry Division, the battalion was reorganized and redesignated as 3rd Battalion, 227th Aviation Regiment in July 1987 and was reassigned to 3rd Armored Division in Germany. The battalion was reorganized in its present configuration in April 1989 in Fort Hood, Texas where it traded its AH-1 COBRA's for the AH-64 APACHE. While at Fort Hood the unit conducted a rigorous 3 month training program with the APACHE's and finally returned to Hanau, Germany in September 1989, to join the 3rd Armored Division as its first APACHE battalion.

In August 1990 the battalion was attached to the 12th Aviation Brigade as part of Operation Desert Shield and was deployed to Saudi Arabia in September.

The battalion played a key role in the early months of Desert Shield and found itself attached to the XVIII Airborne Corps when war broke out on 17 January 1991. During the conflict, 3rd Battalion conducted several successful engagements in Iraq to include an attack north of the Euphrates River distinguishing itself as the U.S. Army's northern most unit at the end of the war.

The unit redeployed to Germany in April 1991 and was reassigned along with its sister unit 2nd Battalion, 227th Aviation to the 1st Armored Division in September 1991. The battalion currently is stationed at Hanau Army Airfield (HAAF), Federal Republic of Germany where it stands trained and ready for action, anywhere in the world.

Left: Crewmembers at work boresighting "DRAGON SLAYER"'s gun. Lots of these procedures can be executed outside the hangar and only require an auxiliary power unit. The APACHE is seen chained to the tarmac as a precaution during testing or when heavy winds are crossing the airfield.

Bottom left: Inside detail of the main landing gear strut. Note the semi-gloss shock strut, the forward facing cable cutter (to snap power line cables in straight level flight) and the very low pressure tire.

Bottom right: The APACHE has a very characteristic look with its exposed TADS/PNVS (Target Acquisition and Designation System)/ Pilot Night Vision System) in the nose, a narrow main structure with tandem seats and two side sponsons holding the main avionics. Note the various deflectors and cable cutters.

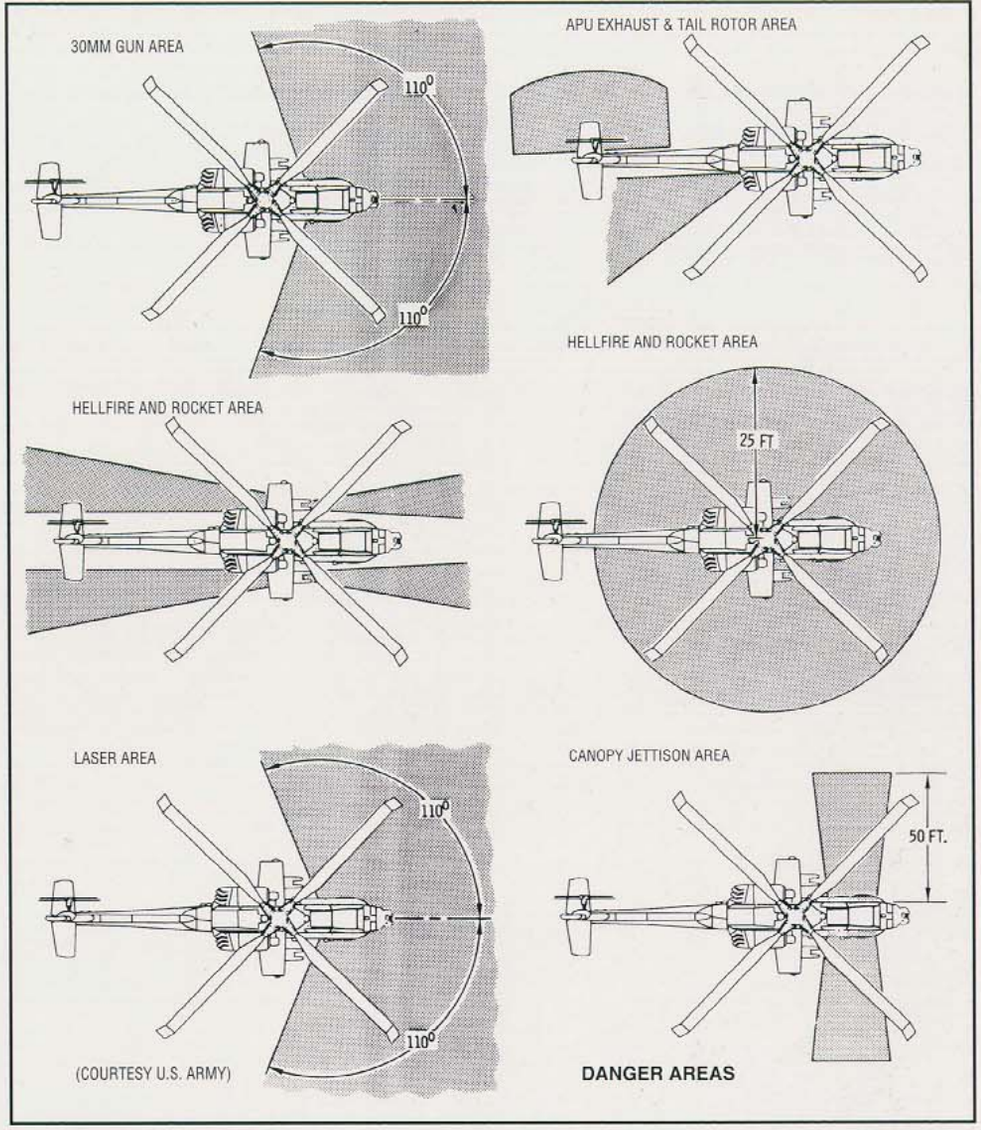
Next page: A close look showing the attachment of the shock absorber aside the pilot's cabin and both refuelling points aft of the cabin. Note the steps and handholds. Also note the upper IFF Transponder antenna and the Radar Jammer receiving antenna (see also page 11).

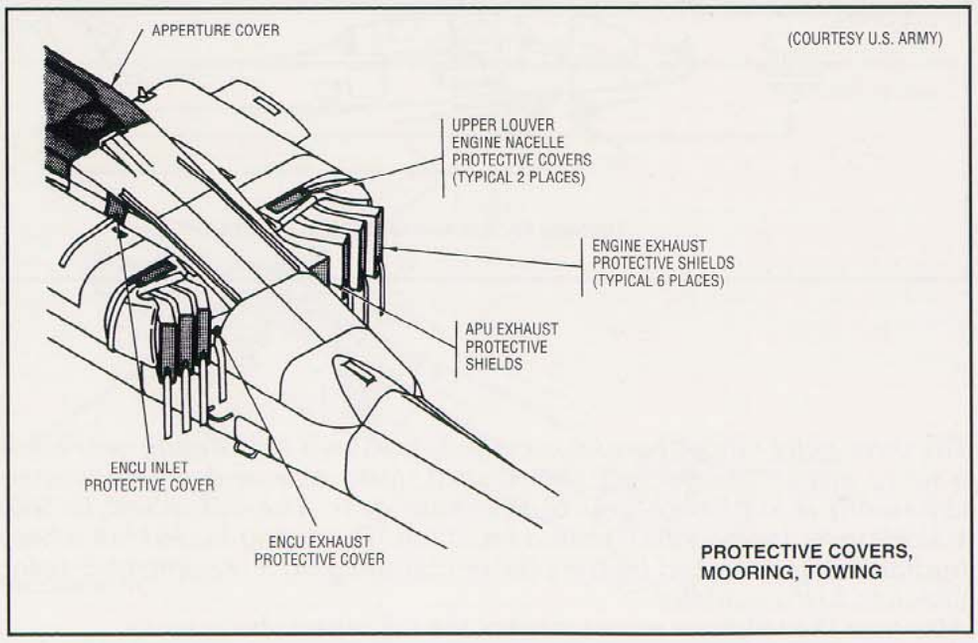
Above: The wings are of aluminum cantilever, spar and rib construction and have two hardpoints for external stores. The outboard pylon holds the Apache's primary armament for destruction of tanks, the point target weapons system or "Hellfire" missile. Up to four of these missiles can be carried on each pylon. The Hellfire currently has the tri-service type laser seeker which means it can be locked on before launch (LOBL) or after it leaves the launch rail (LOAL). The real life Hellfire's used against Iraq (at right) show the inevitable "war poetry".
The inboard mounted M-261 lightweight nineteen tube launcher can fire 2.75 inch folding fin aerial rockets (FFAR) in three modes: pilot, CPG or cooperative (precision) mode. It is considered a light anti-personnel assault weapon.
Note the pilot tube on the wing attack board and the small panel at the aft side end which covers the crewmember communication receptacle.

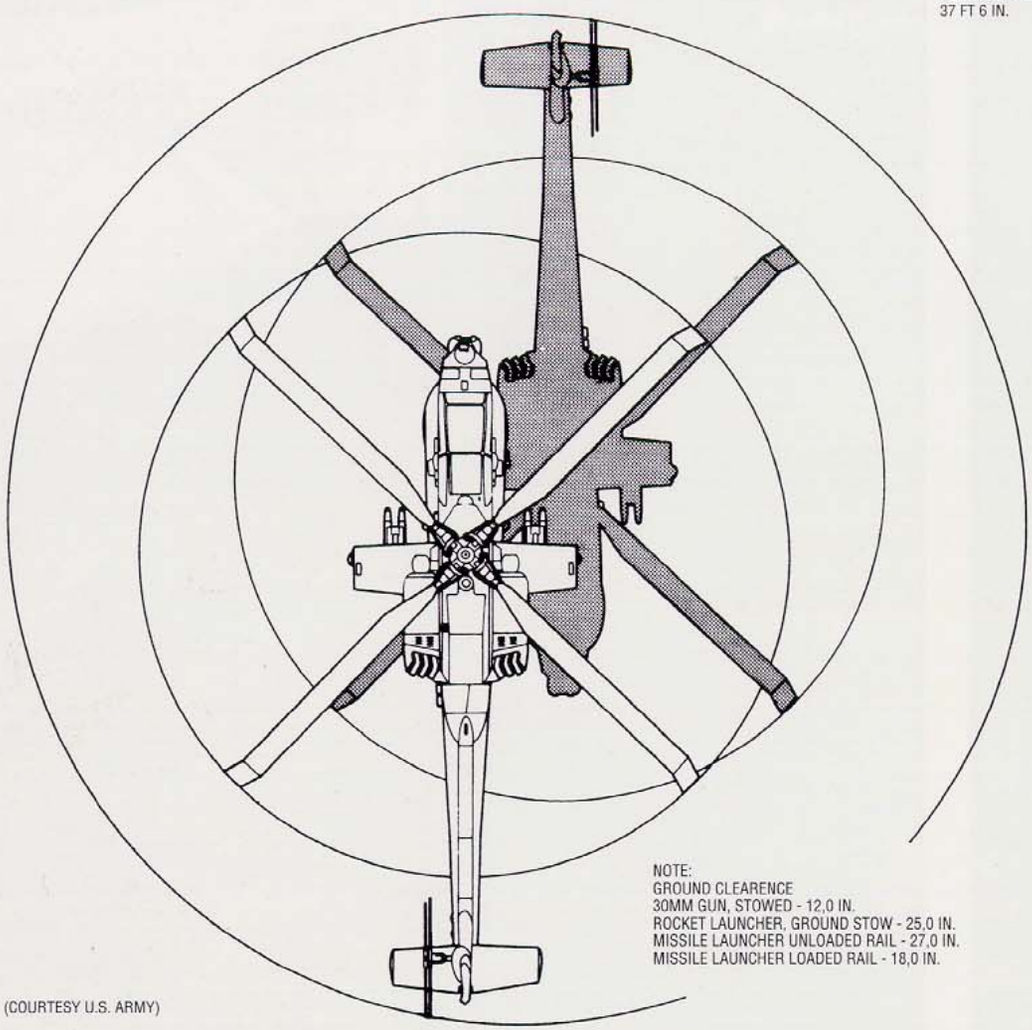
The right side avionics bay is located just below the engine exhaust and has some built-in test buttons. The door (with four ventilation ports and painted a contrasting yellow) locks underneath the large engine nacelle support bar.

(Photo via Capt. Peyton N. RANDOLPH)

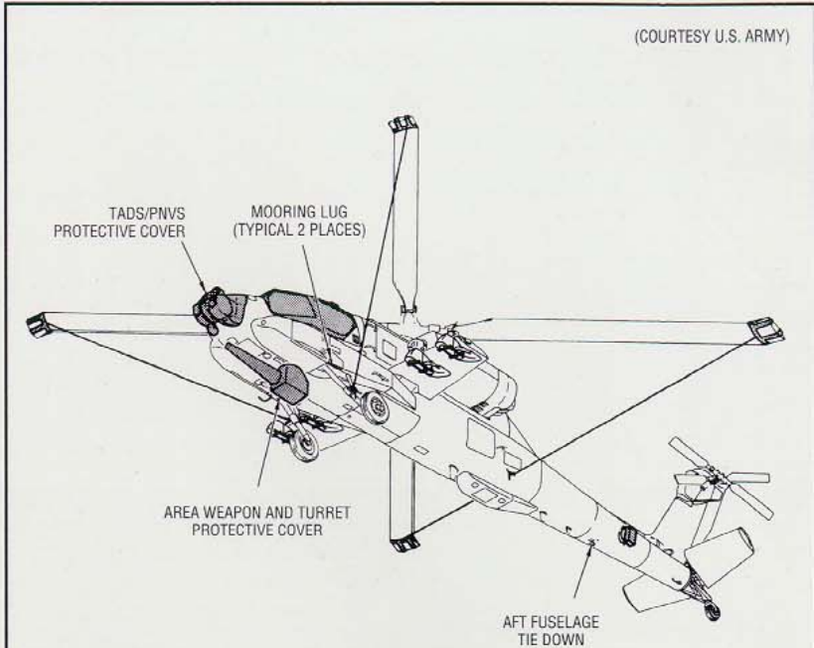
(Photo via Capt. Peyton N. RANDOLPH)




APPERTURE COVER
(COURTESY U.S. ARMY)
UPPER LOUVER ENGINE NACELLE PROTECTIVE COVERS (TYPICAL 2 PLACES)
ENGINE EXHAUST PROTECTIVE SHIELDS (TYPICAL 6 PLACES)
APU EXHAUST PROTECTIVE SHIELDS
ENCU INLET PROTECTIVE COVER
ENCU EXHAUST PROTECTIVE COVER
PROTECTIVE COVERS, MOORING, TOWING



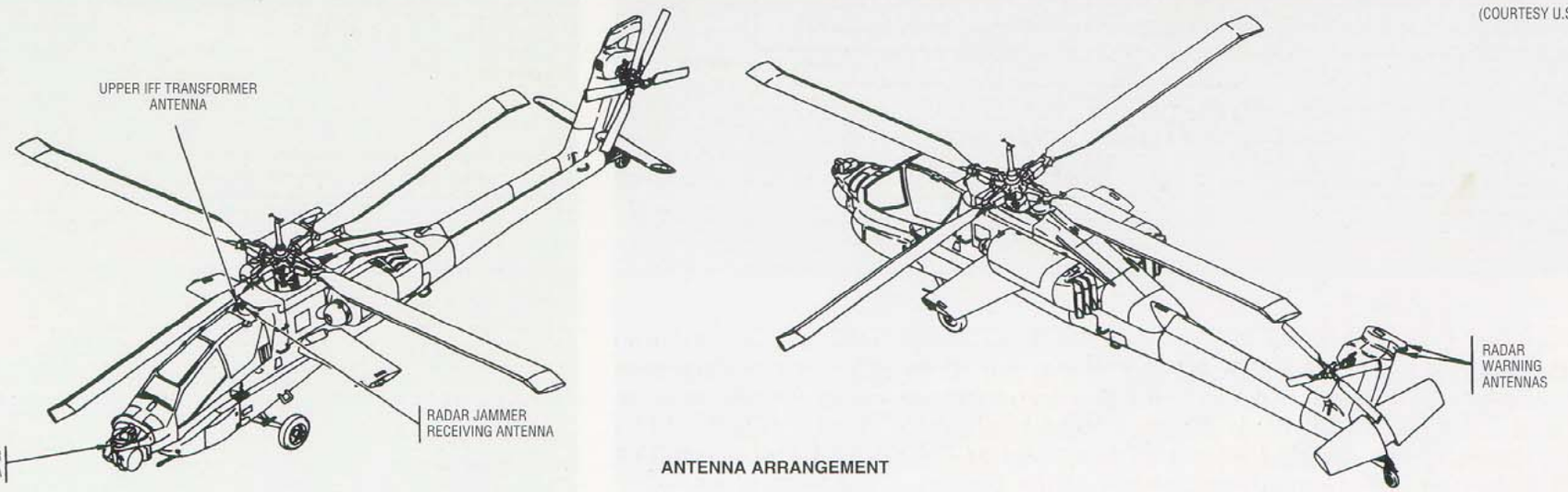
TURNING RADIUS AND GROUND CLEARANCE



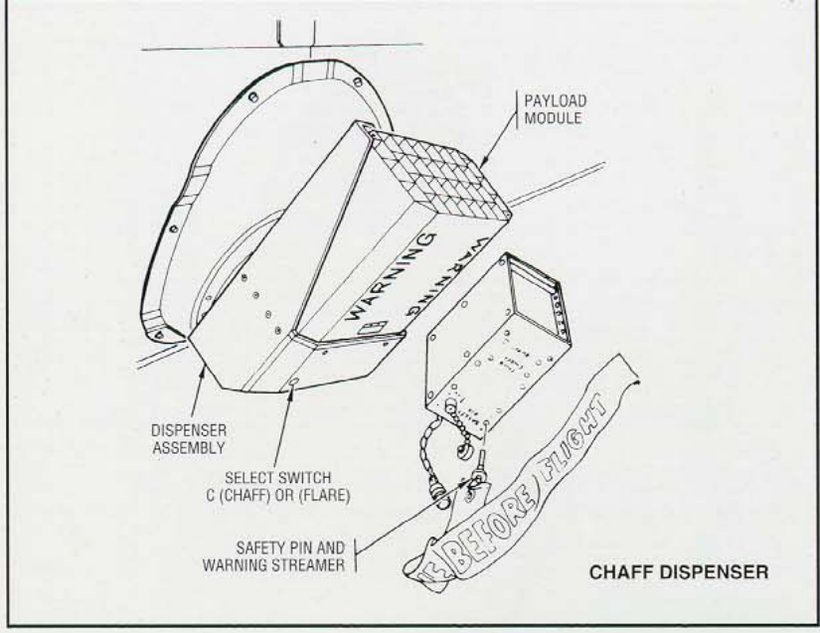
PROTECTIVE COVERS

The three-point landing gear system incorporates a tail landing gear consisting of two trailing arms, nitrogen/oil shock strut, fork, axle and wheel. Impact-absorbing capability is similar to that of the main gear. The tail wheel is 360-degree free swiveling for landing and ground handling. The spring-loaded tail wheel lock can be hydraulically unlocked by the pilot or manually by a crewmember using the handle attached to the actuator.
Also note the tailplane actuator left of the tail wheel shock strut.

(COURTESY U.S. ARMY)



ANTENNA ARRANGEMENT



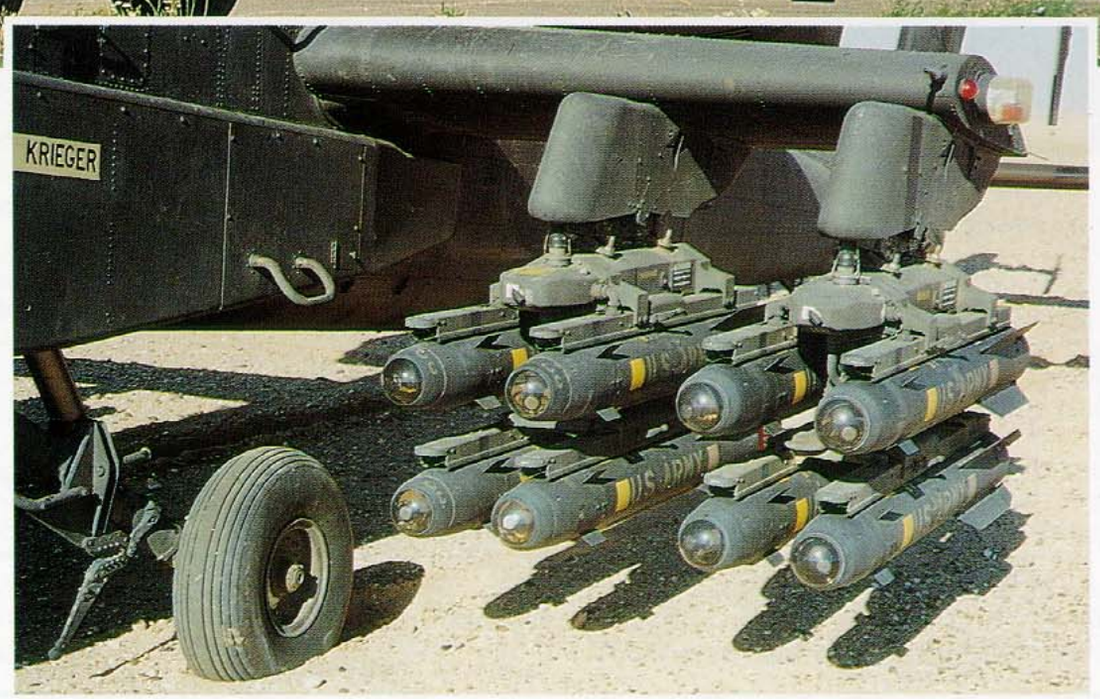
CHAFF DISPENSER

Retractable steps facilitate quick checks of the tail rotor assembly, mandatory procedure during preflight checks. The tail rotor assembly, providing antitorque action and directional control, is a very complex mixture of forks, swashplates, sciccors,bearings, etc. ranging from stainless steel to titanium. All movement is controlled through the intermediate gearbox at the bottom of the vertical stabilizer which also reduces the driveshaft RPM.

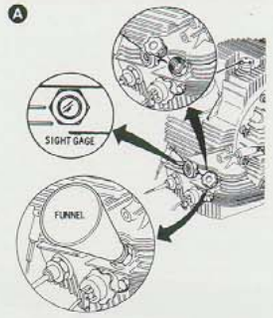
APACHE in peacetime training configuration. Note the 3/227th unit marking on the aft part of the engine housing.

Right: Anti-tank missions during the Gulf War were usually flown with a full load of Hellfire missiles which totalled 16, 8 on each wing. They can be launched in two types of modes: normal (or rapid); and ripple by both the pilot and copilot/gunner in alternating left and right wing sequence with the outer missile at the bottom row (left first) heading the launch.

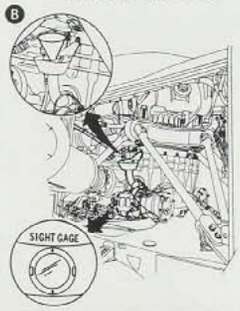
Left: Apart from its offensive weapons the APACHE carries an M-130 dispenser in which 30 M1 chaff cartridges can be stored which, when fired, provide effective countermeasures against radar guided defense systems.



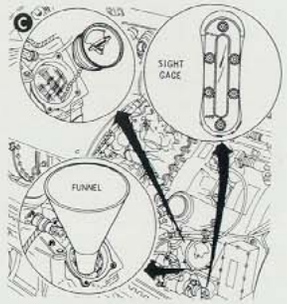
(Photo via CPT Scott B.THOMPSON



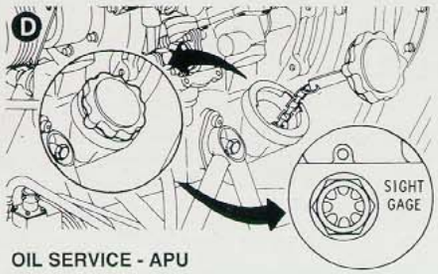
OIL SERVICING-ENGINE NOSE GEARBOX



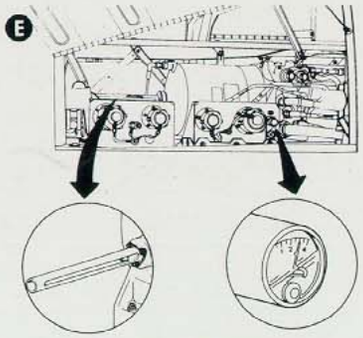
OIL SERVICING-MAIN TRANSMISSION



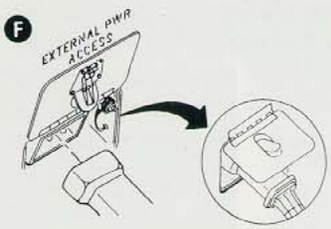
OIL SERVICING-ENGINE



OIL SERVICE - APU

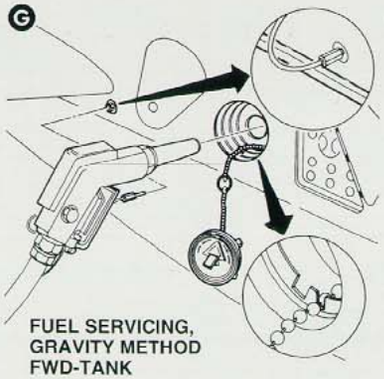


OIL SERVICE - HYDRAULIC

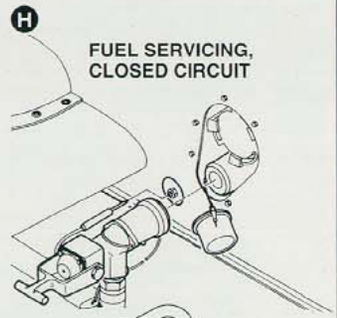


EXTERNAL POWER RECEPTACLE

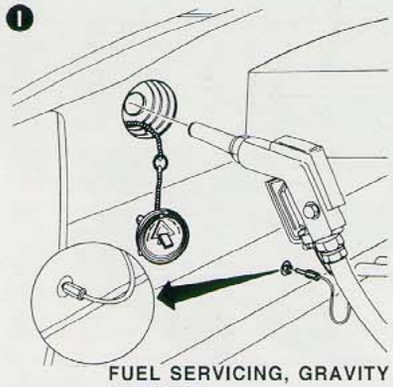
(COURTESY U.S. ARMY)



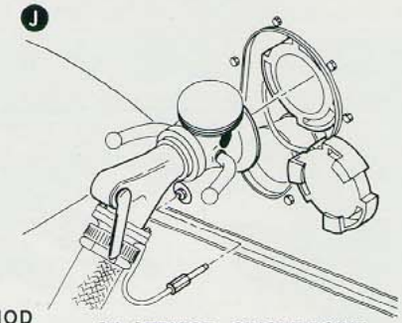
FUEL SERVICING, GRAVITY METHOD FWD-TANK



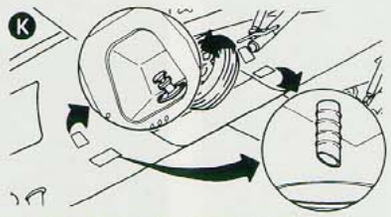
FUEL SERVICING, CLOSED CIRCUIT



FUEL SERVICING, GRAVITY METHOD AFT-TANK

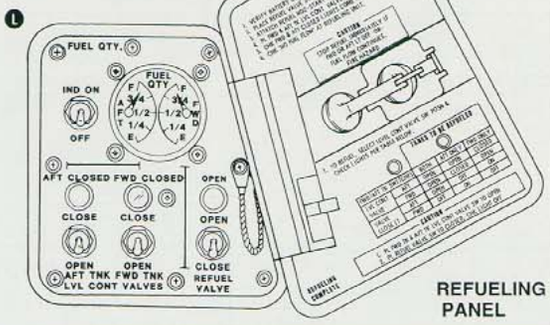


OIL SERVICE - SINGLE POINT

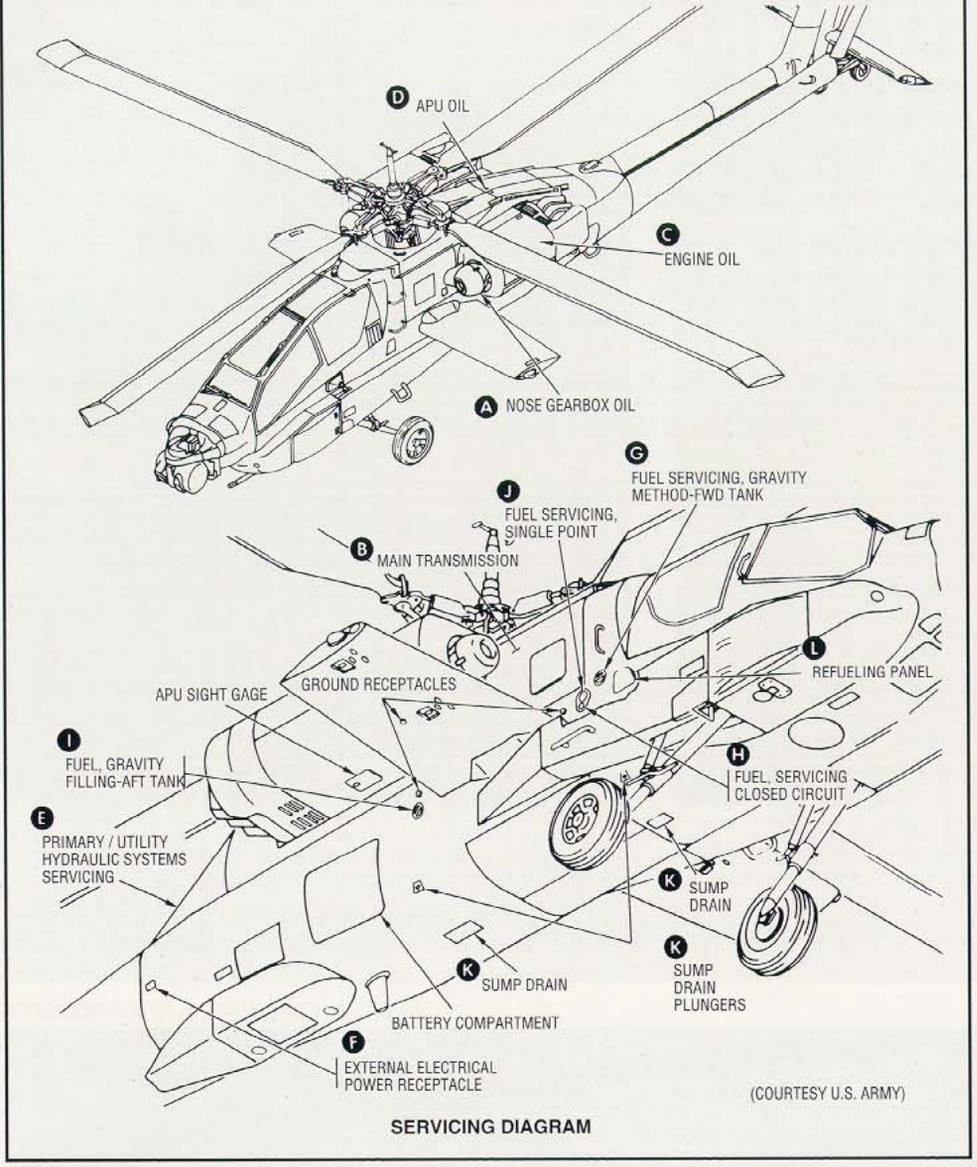


FUEL SUMP DRAINS AND PLUNGER

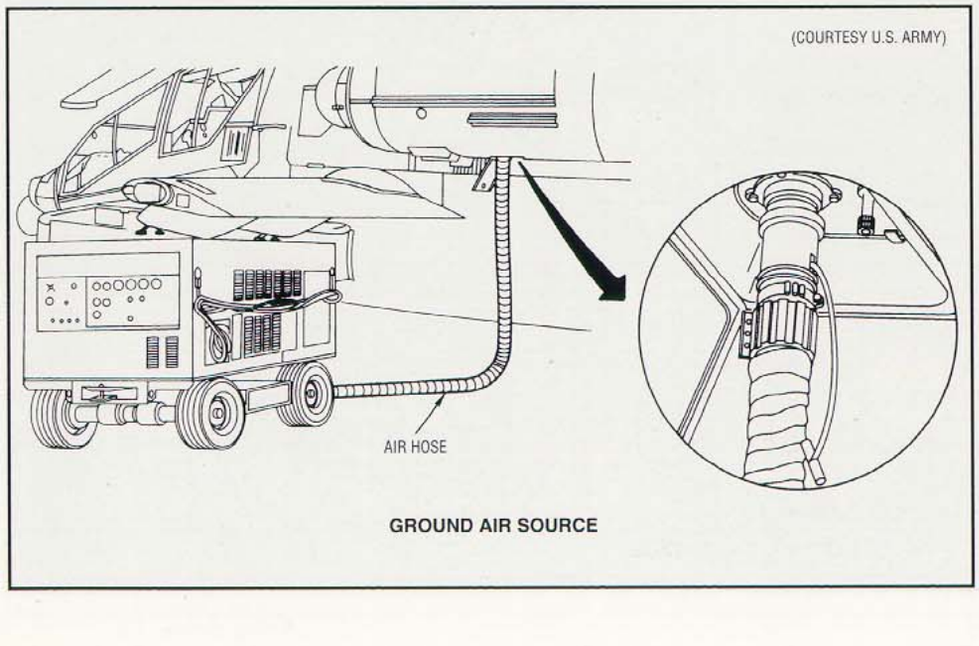
FOR LOCATION SEE NEXT PAGE



REFUELING PANEL

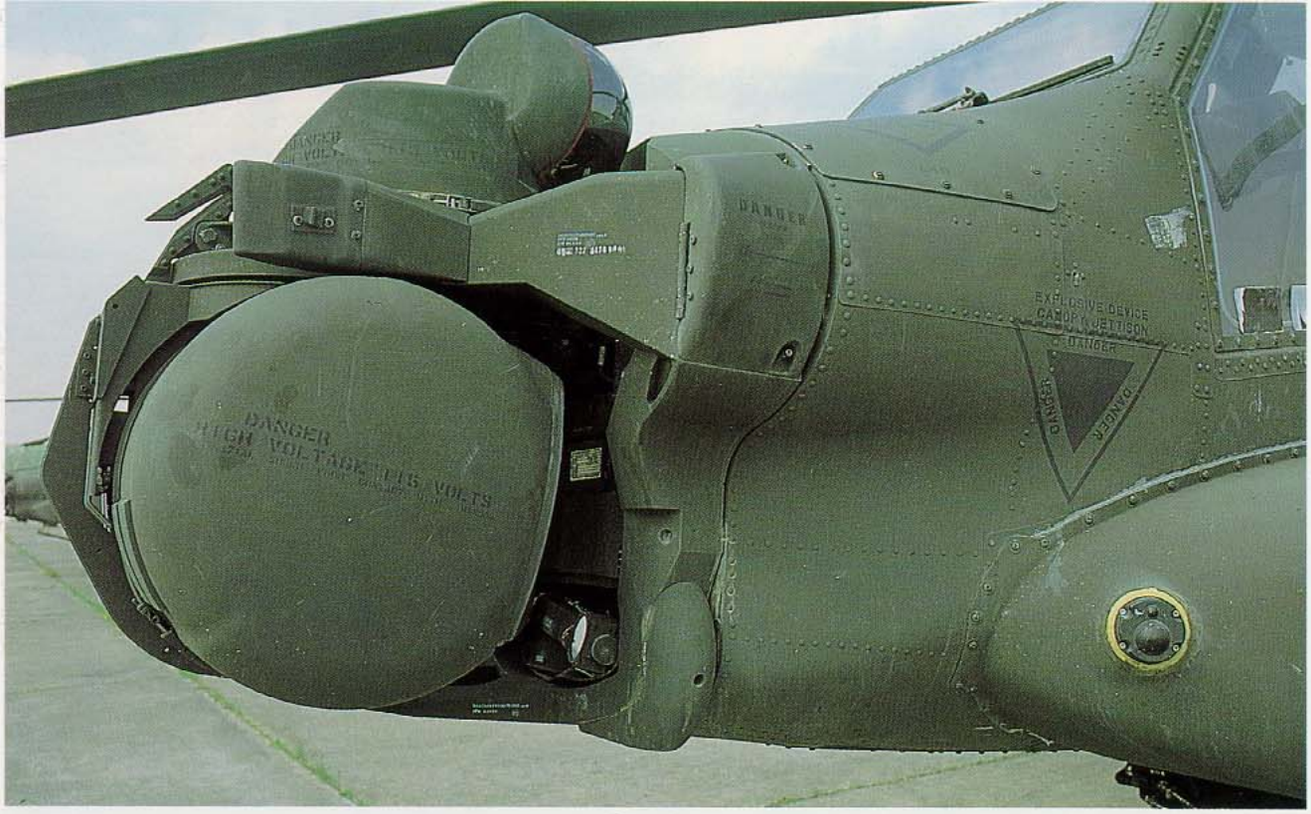


SERVICING DIAGRAM



GROUND AIR SOURCE

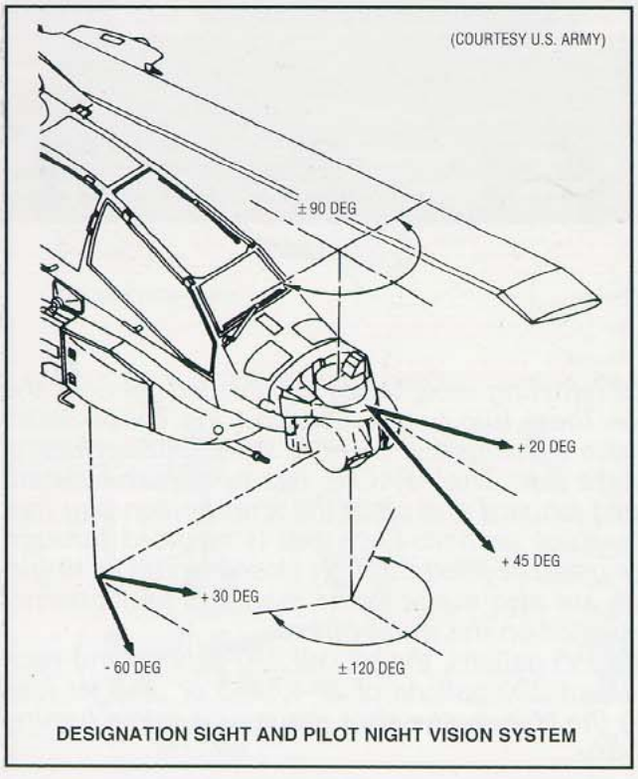
Oil servicing stations and refueling receptacles are located all over the aircraft as is illustrated on these two pages. Oil servicing concentrates around the engine and main transmission on both sides while refueling is only executed on the right side. The APACHE has two crash-resistant self-sealing fuel cells located forward and aft of the ammunition bay (see page 29) in the center fuselage section. Each cell is serviced through gravity filler receptacles or pressure-filled through closed-circuit or single-point adapters. Provisions are also made for as many as four external auxiliary fuel tanks to be carried on the stores pylons.
The forward fule cell holds 155 gallons, the aft cell 220 gallons and each auxiliary tank can take about 220 gallons of JP-4, JP-5 or JP-8 jet fuel. Rapid refueling with only the N°2 engine shut down and rotors turning is practiced on a regular basis.



The nose-mounted mission avionics consisting of the Pilot Night Vision Sensor (PNVS) (AN/AAQ-11) which is a stabilized FLIR contained in a rotating turret mounted above the TADS or Target Acquisition Designation Sight (AN/ASQ-170).
The PNVS is used by the pilot for externally aided vision at night or during adverse weather conditions.

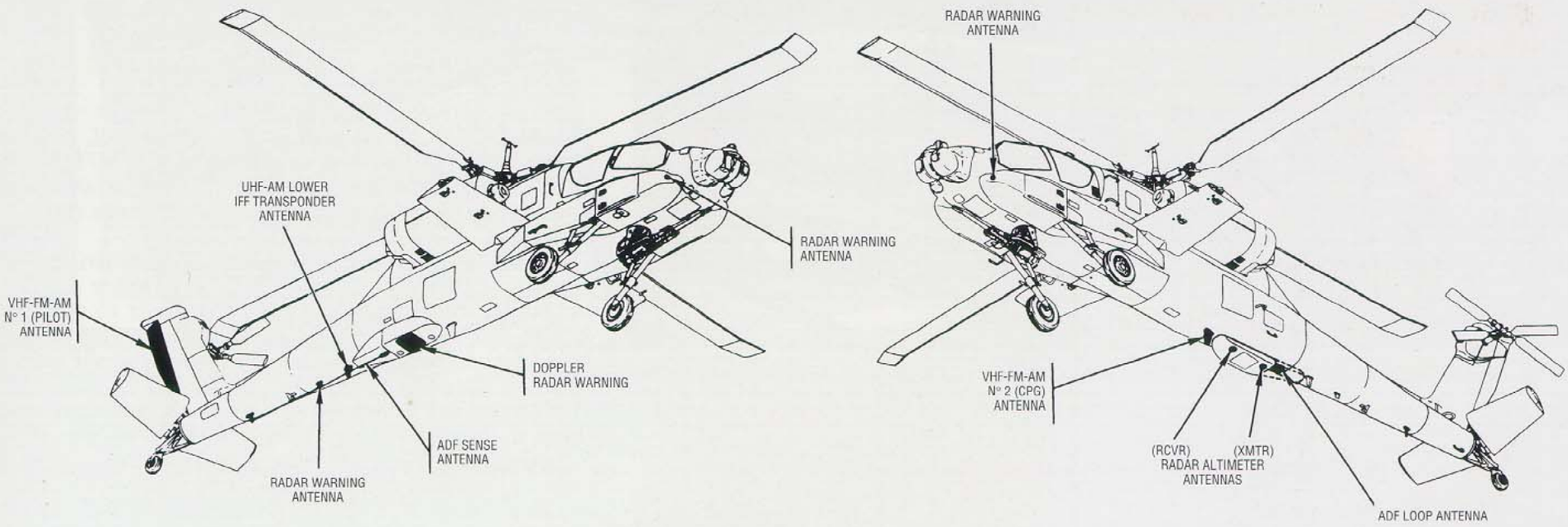
The TADS provides the CPG with day and night target acquisition by means of a direct view optical (DVO) telescope, a day television (DTV), and a forward looking infrared (FLIR) sensor system.

(Photo via Capt. Peyton N. RANDOLPH)



DESIGNATION SIGHT AND PILOT NIGHT VISION SYSTEM

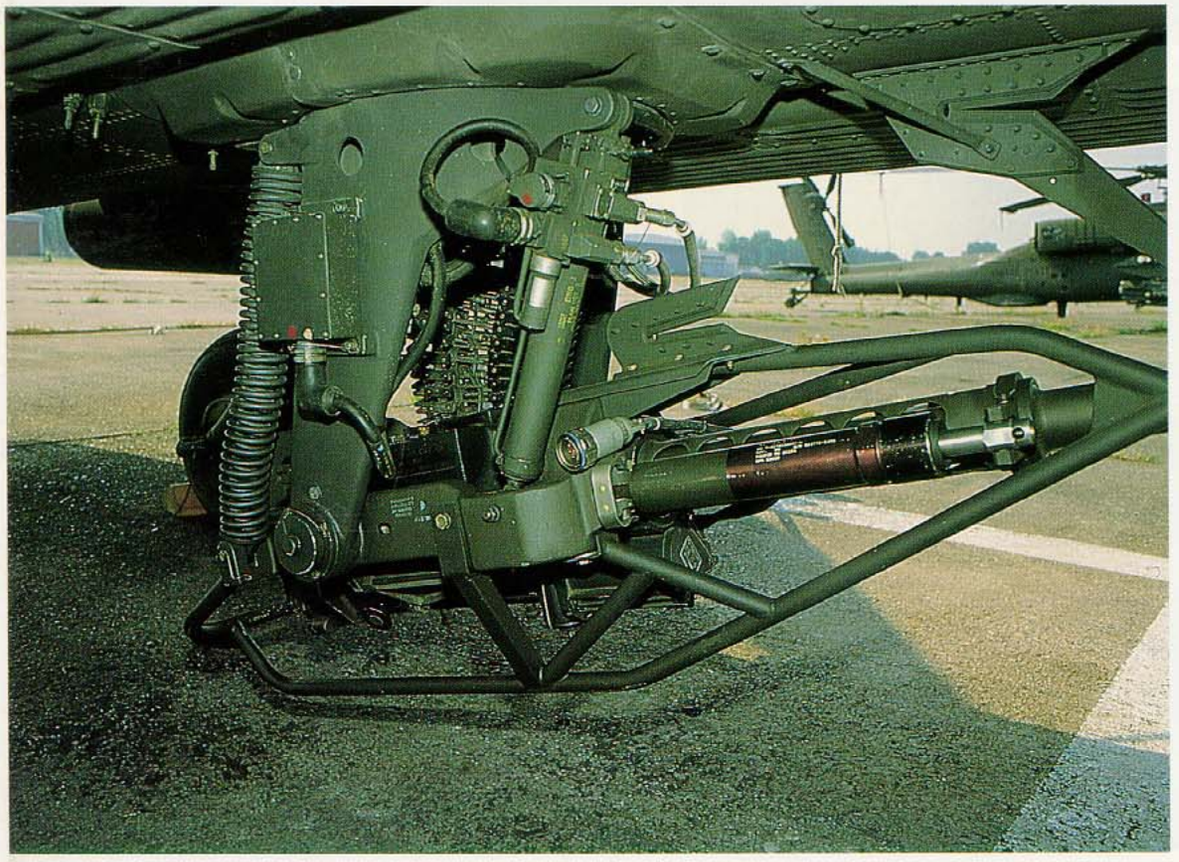
An APACHE stripped of its rotor blades positioned somewhere on the Hanau tarmac. Each main rotor blade is a constant-chord asymmetrical airfoil. The outboard tip is swept aft 20 degrees and tapers to a thinner symmetrical section. The blade has a 21-inch chord. Chordwise, the leading-edge and forward half of the blade is a four-cell structural box of stainless steel and fiberglass with a stainless steel spar. The aft half of the blade has fiberglass skin with a nomex honeycomb core and a bendable trailing edge strip to aid in blade tracking.
The blades may be folded by removing the appropriate blade attachment pin and adjacent pitch link bolts.

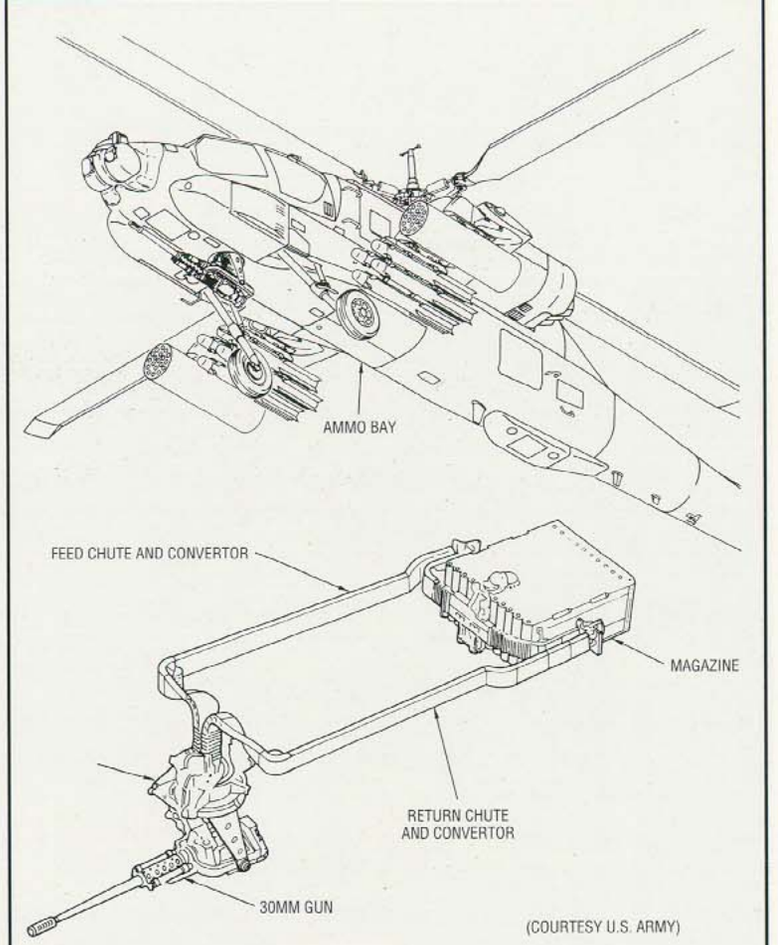


ANTENNA ARRANGEMENT

(COURTESY U.S. ARMY)

The 30mm gun in stowed position mounted centrally below the fuselage. Note the side sponsons (with recessed bottom covers) are not mounted flush with the rest of the bottom fuselage. Two more cable cutters are mounted in this area, one below the fuselage and one on top of the cable deflector surrounding the gun.



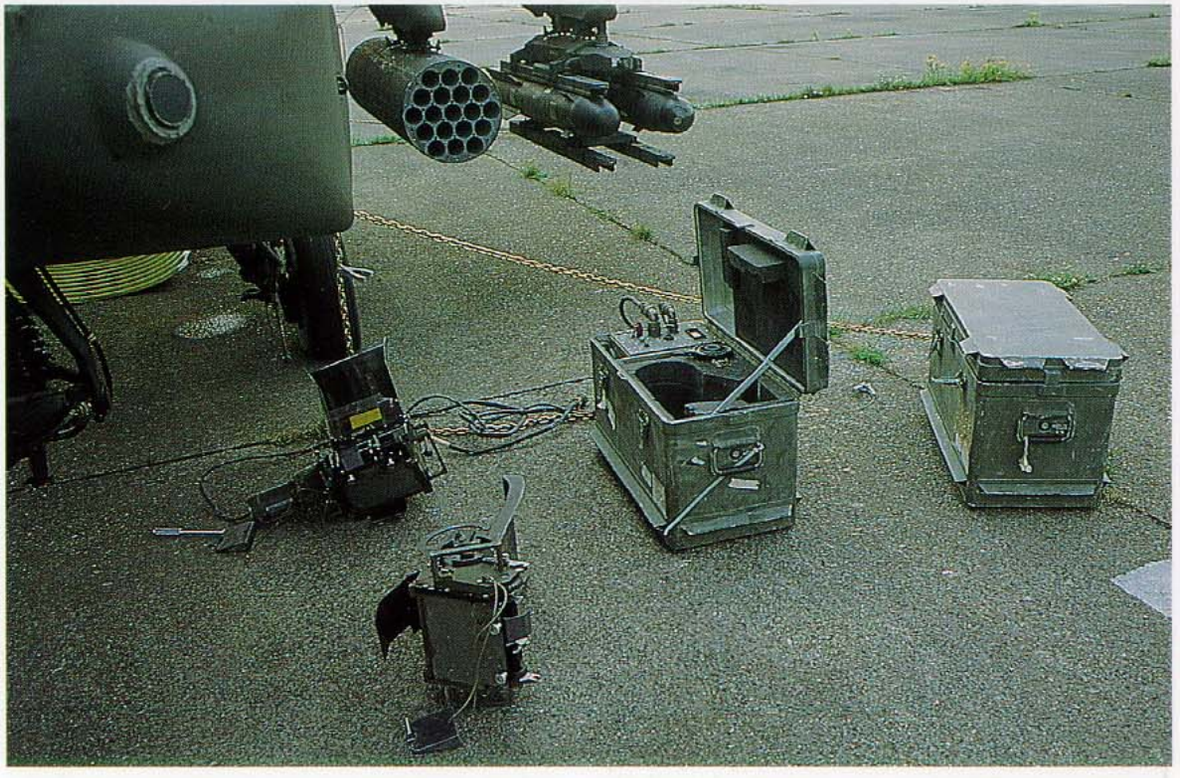


M-230E1, 30MM AREA WEAPON SYSTEM

The M-230E1, 30mm gun is a single barrel, externally powered, chain drive weapon using M788/789 or ADEN/DEFA type ammunition. ADEN type ammunition uses brass cartridges while DEFA rounds have steel cartridges.

The gun is mounted in a hydraulically driven turret capable of slewing the gun 110 degrees left or right of the helicopter centerline and up 11 degrees to 60 degrees down. In the event of loss of hydraulics, the turret will lock in the current azimuth position and the gun will return to the elevation stow position of 11 degrees up.

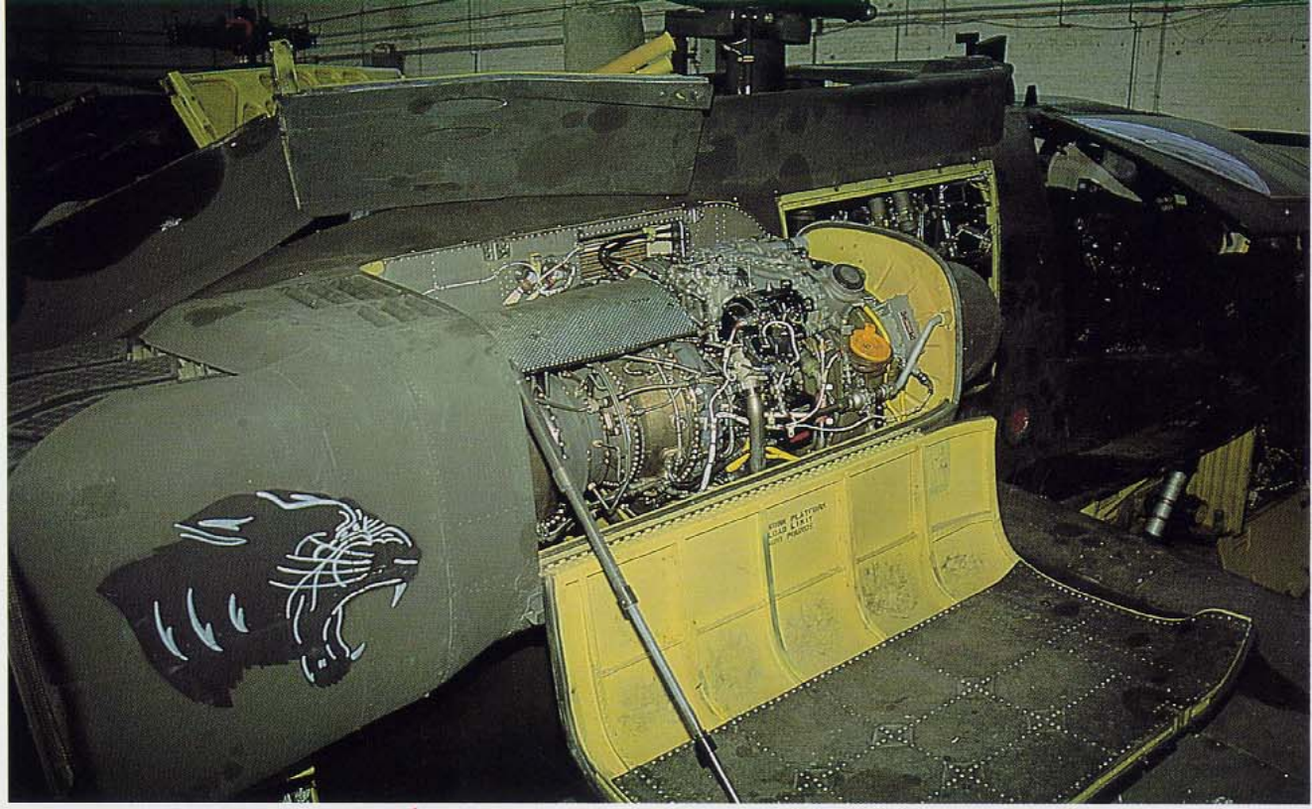
The rate of fire is set for 600 to 650 rounds per minute with a maximum capacity of the linkless storage subsystem of 1200 rounds. The gun duty cycle is as follows: six 50-round bursts with 5 seconds between bursts followed by a ten minute cooling period. For bursts limiter settings other than 50, the duty cycle can be generalized as no more than 300 rounds fired within 60 seconds before allowing the gun to cool for ten minutes.



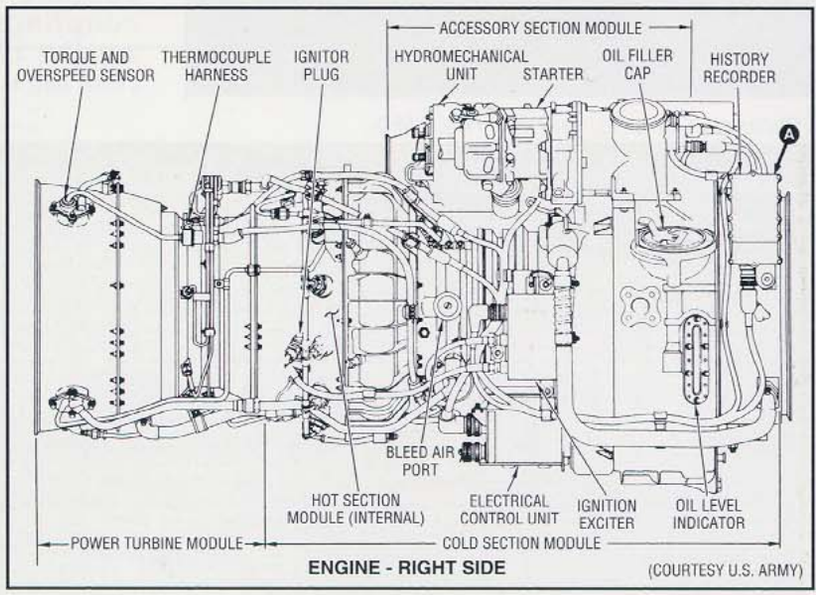
Gun test equipment and loading adapters are stowed in solid custom-made boxes, protected from severe weather conditions such as the ones experienced in the recent Gulf War.
Such equipment is often transferred by road and to areas where the word 'road ' has a different meaning.
Instead of removing the 1200 round magazine (see page 29) ammunition is feeded directly into the feeding system. The adapter can be used to either load or down-load ammunition.

Major overhaul is executed within the protective shelter of large hangars, capable of holding up to 10 APACHE's (without rotor blades installed) at a time. There, stripped of all panels, the helicopter and its systems is thoroughly checked by highly qualified personnel, each specialized in one area of helicopter maintenance.

Left: the door of the forward avionics bay is hinged to facilitate quick "in the field" replacement of modules while the aft part of the fairing needs to be removed completely for maintenance. The slanted main gear trailing arm is attached to the lower fuselage and is designed to absorb vertical impacts of up to 12 feet per second without damage. Note the fire extinguisher accessible through a hatch in the right fairing (see page 7) and the ammo feed conveyor system.



The transmission on the right side of the aircraft can be reached through a large hatch just forward of the N° 2 engine.



ENGINE - RIGHT SIDE (COURTESY U.S. ARMY)

Top left: Avionics comprise intercommunication, FM-AM communication, UHF communication, voice security, automatic direction finder (ADF) Doppler Navigation, IFF, radar altimeter among other subsystems.

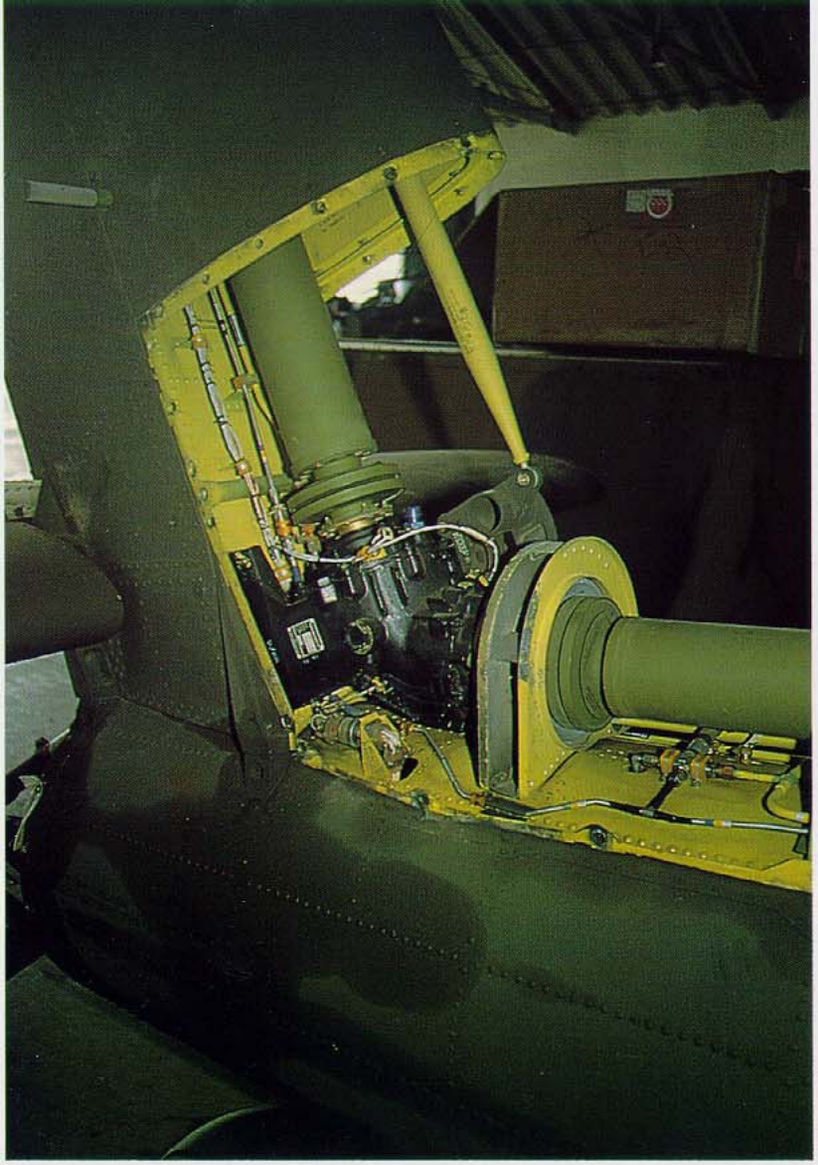
Top right and above: Like many of todays larger helicopters, engine nacelles are designed to serve as working platforms. The engine can be started by an external ground source or by the onboard APU (Auxiliary Power Unit) which also provides on-board power for system checks by ground personnel.
Below-nacelle inspection hatches (with engine cooling louvers) allow quick check-ups.
Note the engine fire access panels outboard of the inspection hatch, the water wash access panel up front and the APU fuel drain and APU vent at left in the small picture above.

Left: Another close look on the aft avionics bay, this time with battery and modules removed showing the mounting racks to good advantage. The compartment to the rear is the survival equipment storage bay which is large enough to store a combat helmet, an environmental survival kit, a survival weapon and a box of field-type rations for both crewmembers.

Right: The tail rotor gearbox, mounted on the vertical stabilizer, reduces the output RPM and changes the angle of drive. The tail rotor output shaft passes through the gearbox static mast. Note the two foldable steps at the top and bottom.

Below: Aerodynamic fairings cover the tail rotor drive shaft which consists of four shaft sections. Three drive shafts, of which two are of equal length, lead from the transmission to the intermediate gearbox. The final shaft is installed on the vertical stabilizer. Bearing hangers support the longer shafts while flexible couplings attached to the shaft ends are capable of accomodating shaft misalingments. Note the way the panels are hinged.

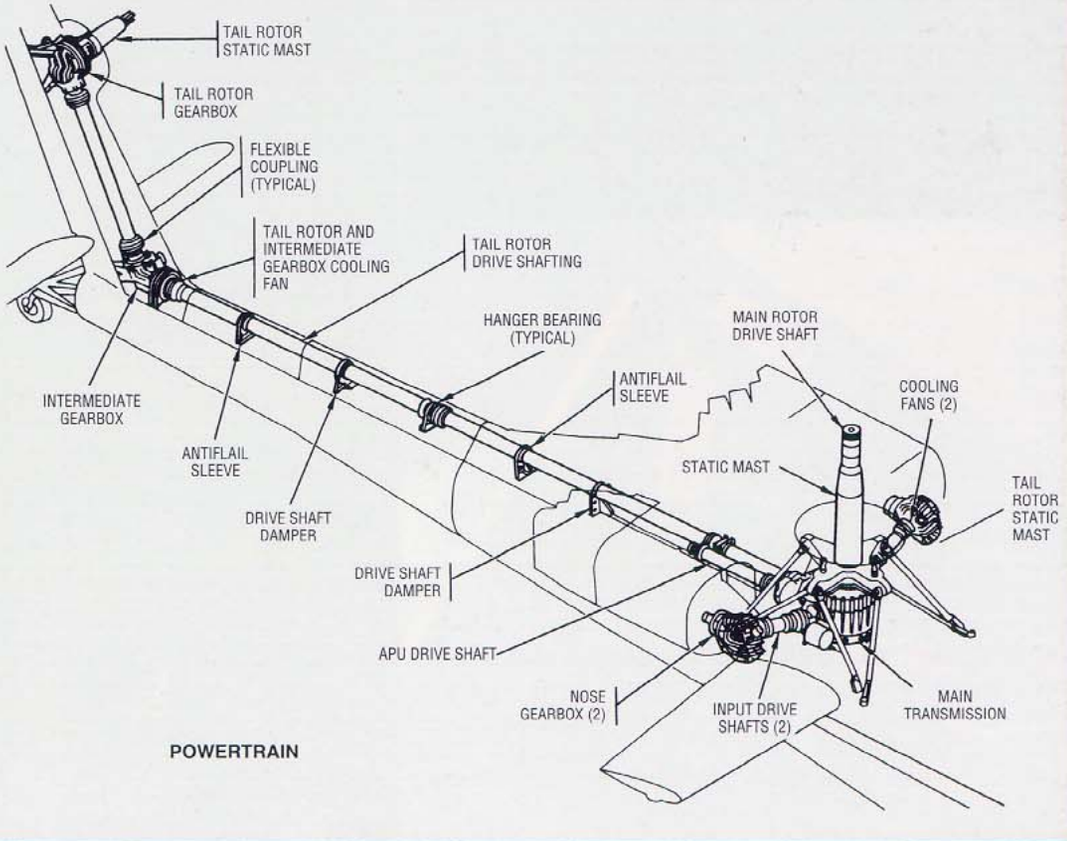
(Photo via Capt. Peyton N. RANDOLPH)



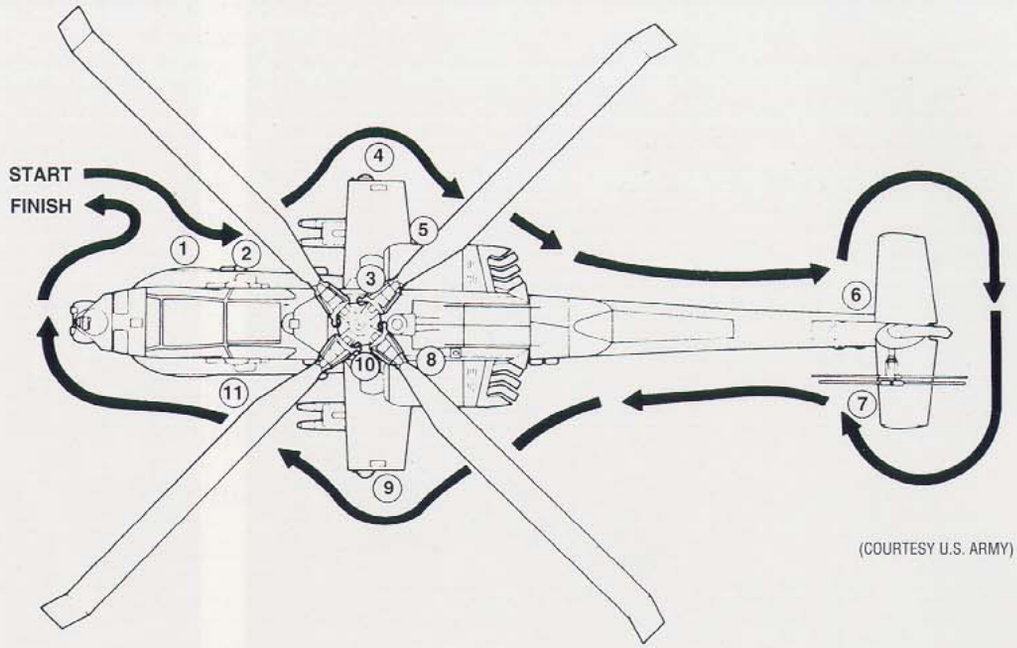
Above: The intermediate gearbox at the base of the vertical stabilizer, also reduces the rpm and changes the angle of drive. It can be seen here coupled to the aft shaft flexible coupling. A fan mounted on the gearbox input shaft draws air from an inlet on the vertical stabilizer (see also page 12). This air cools both the tail rotor gearbox and the intermediate gearbox (which is a grease-lubricated sealed unit). Four thermistors monitor temperature and an accelerometer measures vibration limits which can be monitored by both crew members.

Above right: The tail rotor assembly from the opposite side with a view on the tail rotor static mast. Note the support bar on the latter attached to the vertical stabilizer.

(COURTESY U.S. ARMY)



POWERTRAIN

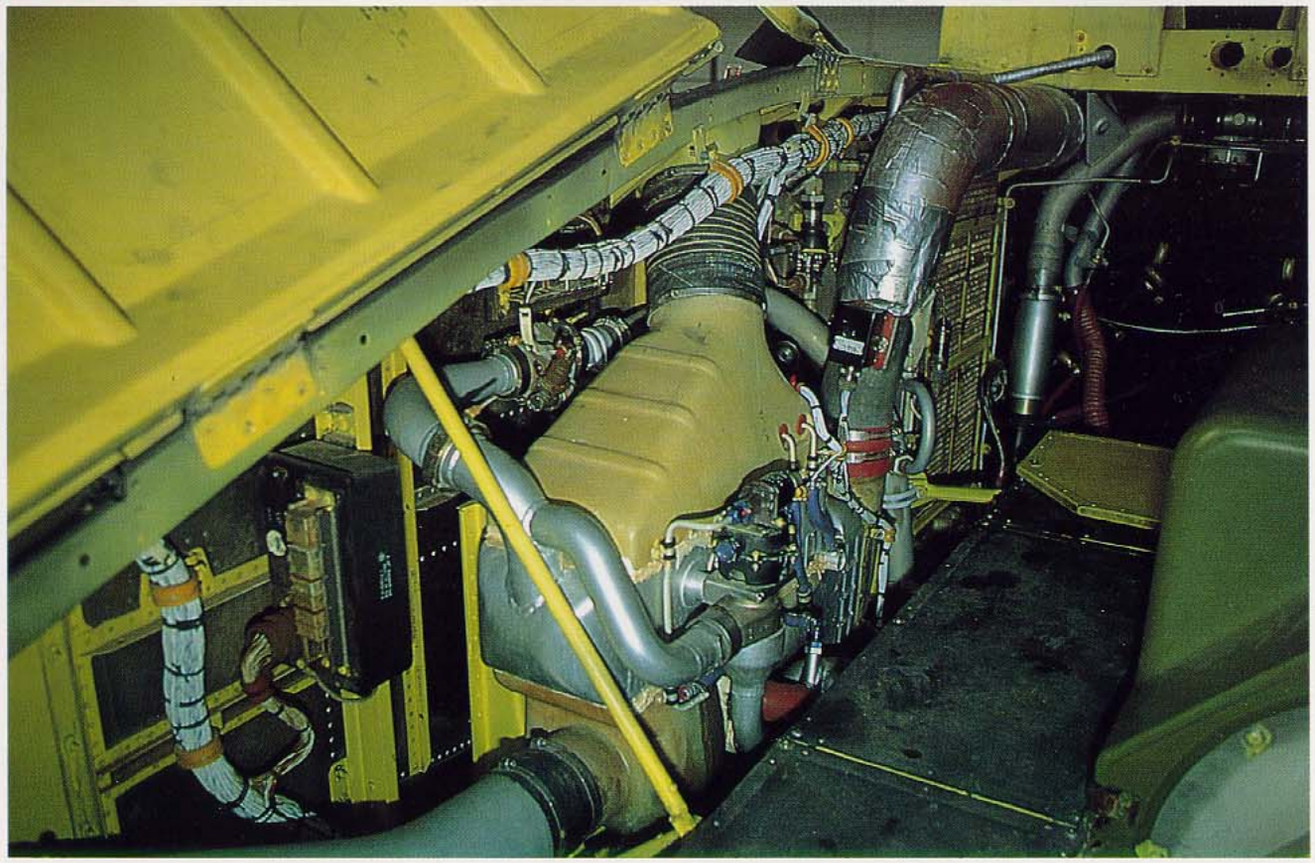


(COURTESY U.S. ARMY)

EXTERIOR CHECK

1 UNDER SIDE FUSELAGE
2 LOWER CENTER FUSELAGE
3 MAST / RIGHT SIDE
4 WING
5 REAR CENTER FUSELAGE
6 AFT FUSELAGE / EMPENNAGE
7 TAIL ROTOR
8 REAR CENTER FUSELAGE
9 WING
10 MAST / LEFT SIDE
11 LOWER CENTER FUSELAGE AND NOSE

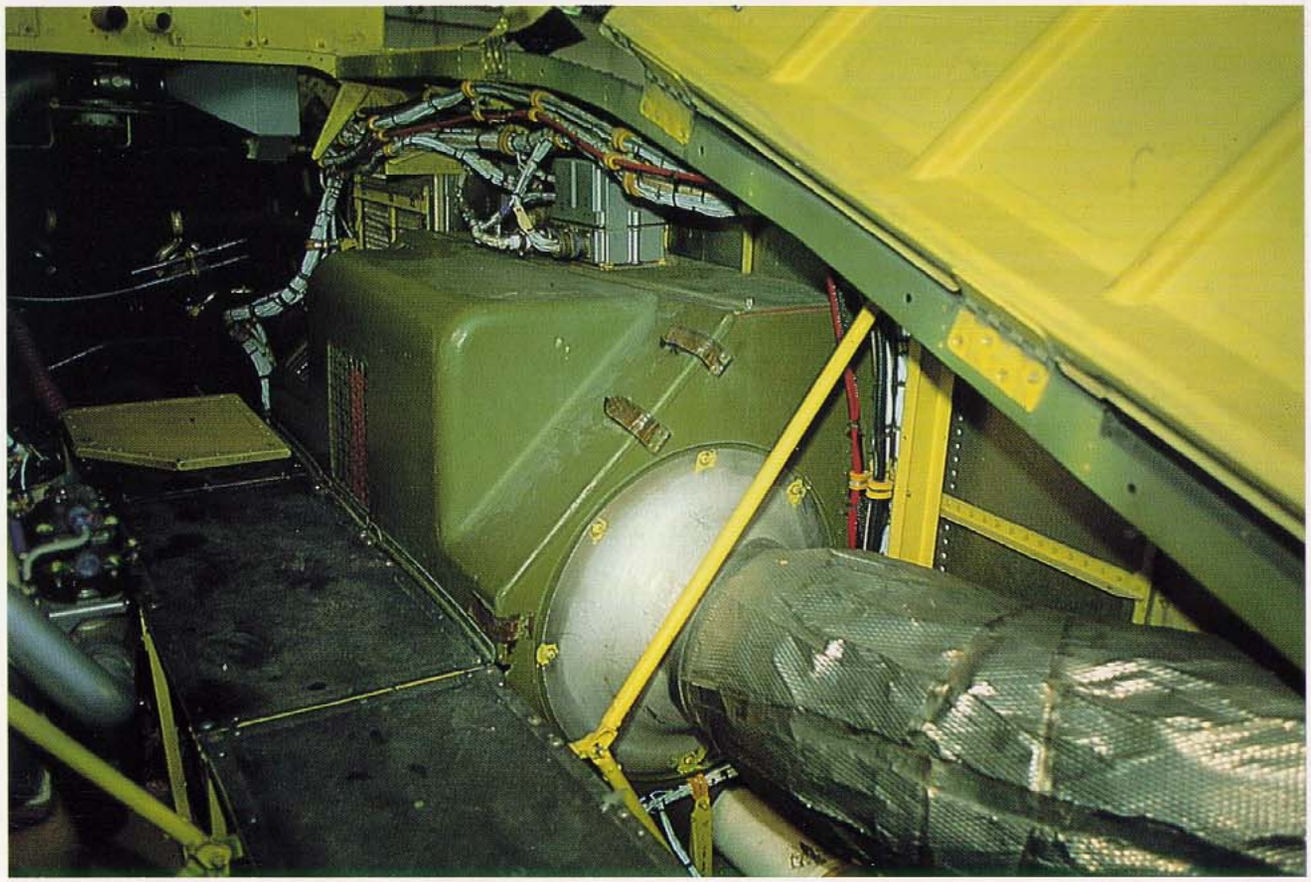
EXTERIOR INSPECTION DIAGRAM

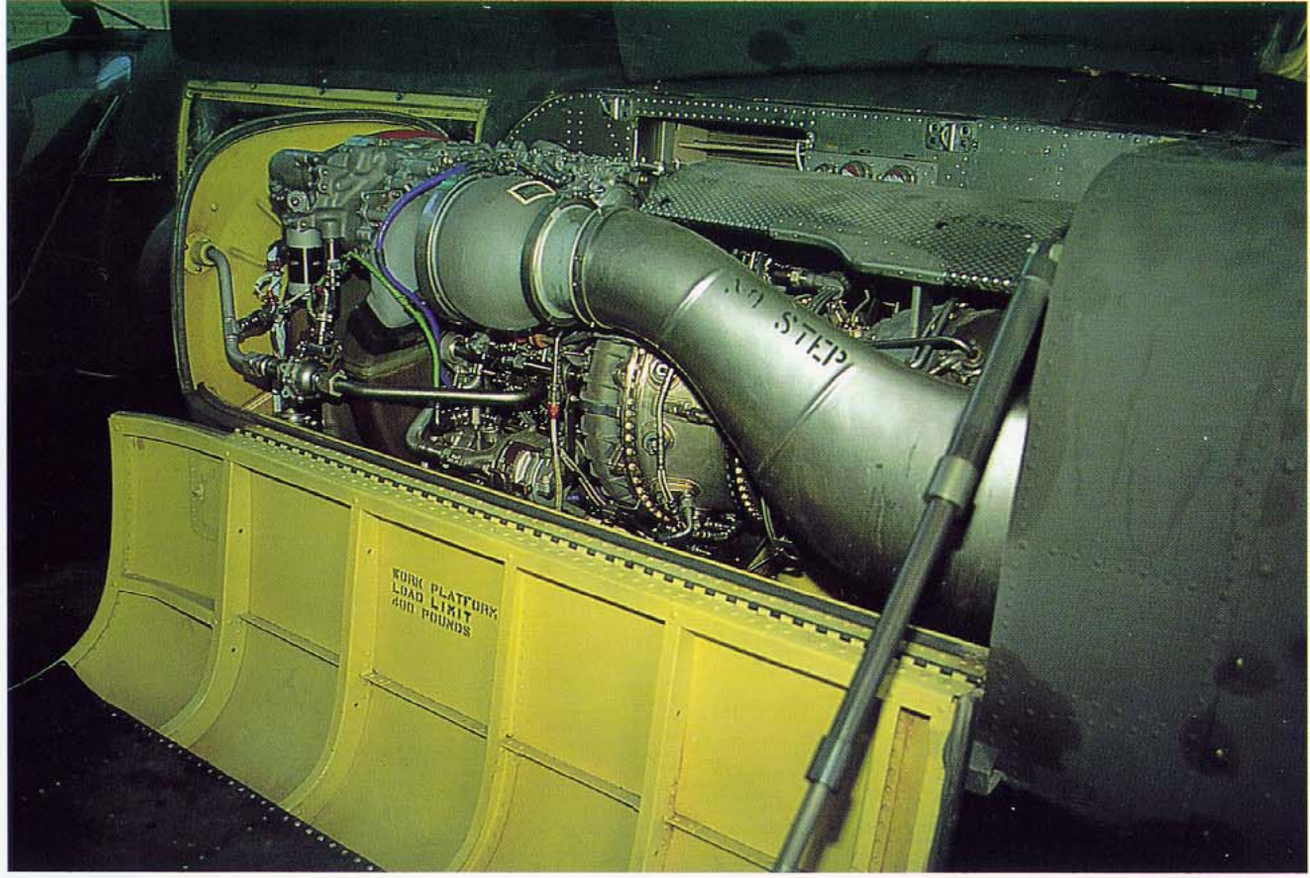


Some of the hydraulic equipment is located in the aft equipment bay which can be reached from the left side of the helicopter. The forward tail section houses a platform on the left and the hydraulic oil servicing compartment on the right. From this platform the upper equipment bay hatches can be opened giving way to the centrally positioned walkway running all the way through to the main transmission compartment. Reservoirs, pipelines and other feed lines are the main subjects in the left side of the equipment bay.

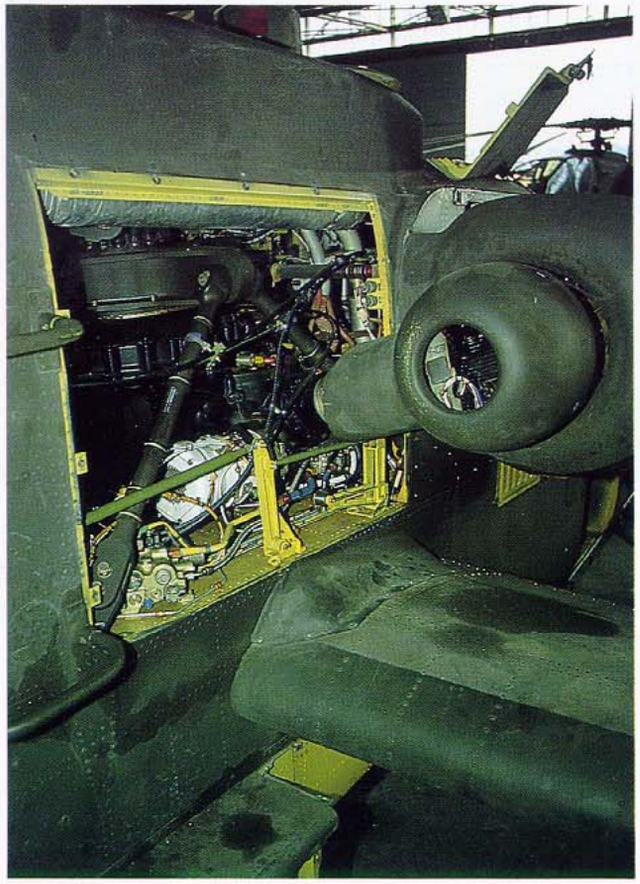
Right: The main rotor head, consisting of a hub assembly, pitch housings, rotor dampers and lead-lag links is a fully articulated system that allows the four blades to flap, feather, lead or lag independent of one another. The main rotor, which is mainly made of steel and aluminum, rotates about a static mast and is controlled by the cyclic and collective sticks through a swashplate mounted on that mast. Mechanical droop stops limit blade droop.
Aft of the main rotor is the AN/ALQ-144 Infrared Countermeasure light (known as the Disco Light). The system transmits radiation modulated mechanically at high and low frequencies using an electrically heated source causing an IR homing missile to break lock-on.

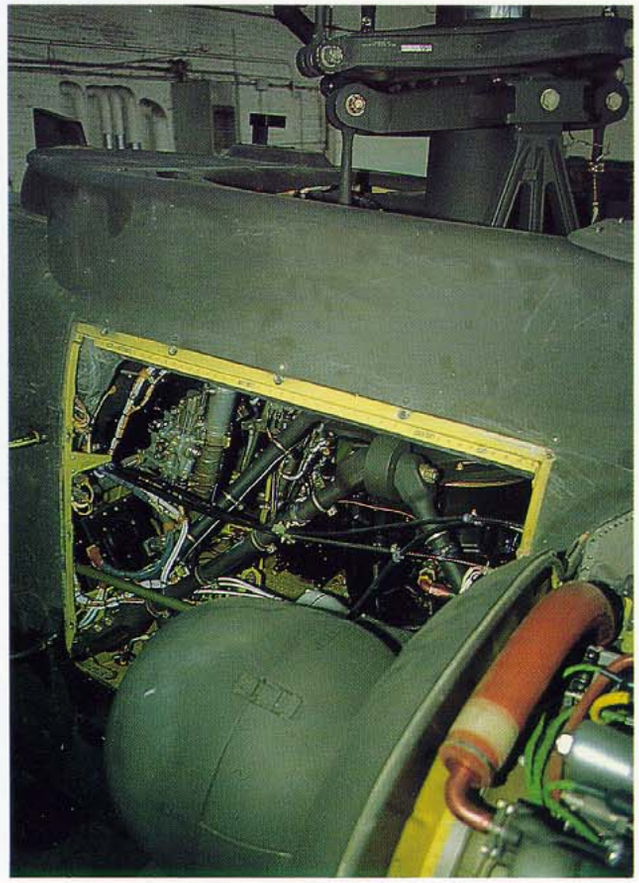
Below right: The APU or auxiliary power unit is located inboard of the right engine nacelle in the aft equipment bay and consists of a gearbox, compressor and turbine section, together with associated fuel, lubrication and electrical system.

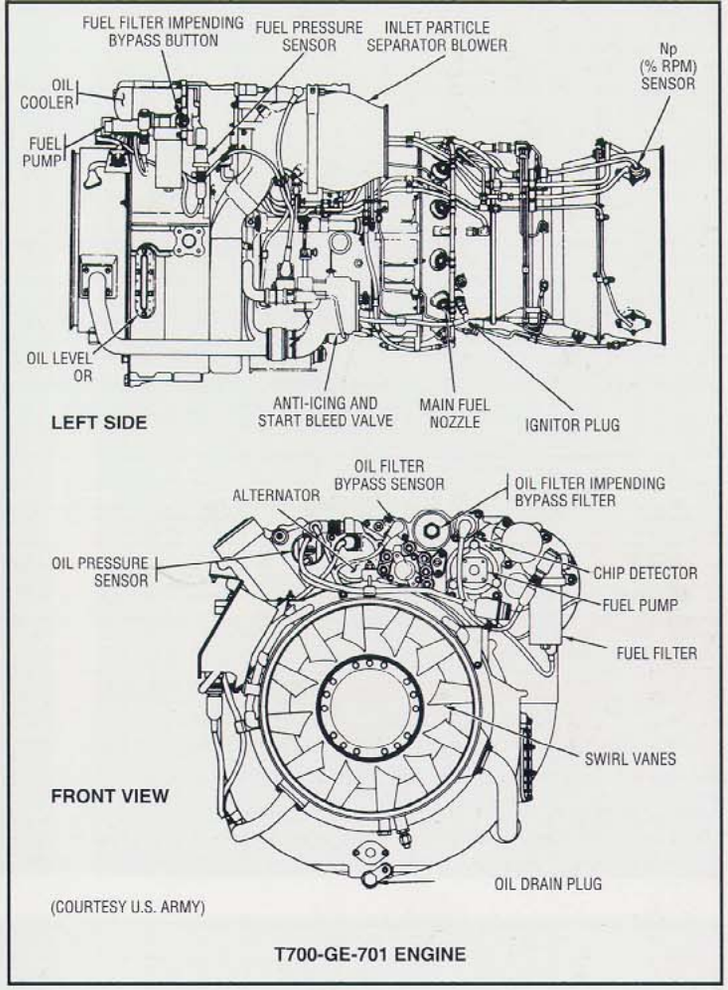




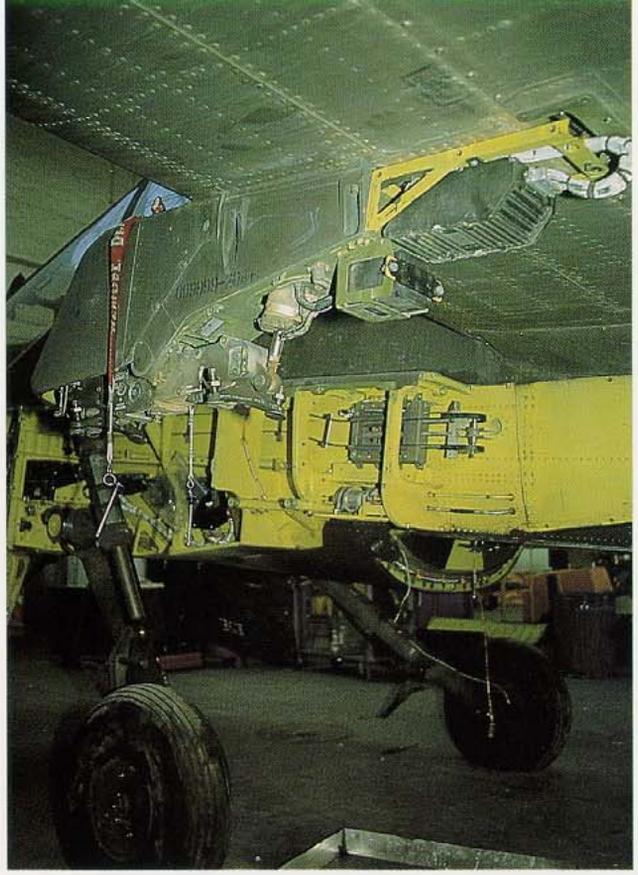
The aft storage bay on the left side is for the stowage of tie down devices, protective covers and other helicopter equipment.





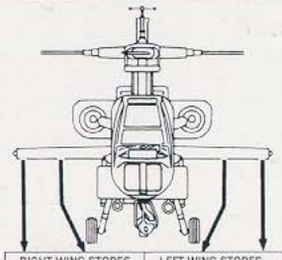


The APACHE is powered by two General Electric T700-GE-701 (1,720shp) front-drive turboshaft engines of modular construction.
The engine is divided into four modules: cold section, hot section, power turbine section and accessory section which includes gearbox, fuel boost pump, oil filter, oil cooler etc. Each engine is cooled by air routed through the engine nacelle. Fixed louvers on the top and bottom of the aft portion of each nacelle and moveable doors (see photo at bottom right, preceeding page) in the bottom forward center of each nacelle accelerate convective engine cooling after shutdown. Note the very clean appearance of the engines.



DRAG CHART AND AUTHORISED ARMAMENT CONFIGURATIONS

(COURTESY U.S. ARMY)



RIGHT WING STORES		LEFT WING STORES	
OUTBOARD	INBOARD	INBOARD	OUTBOARD

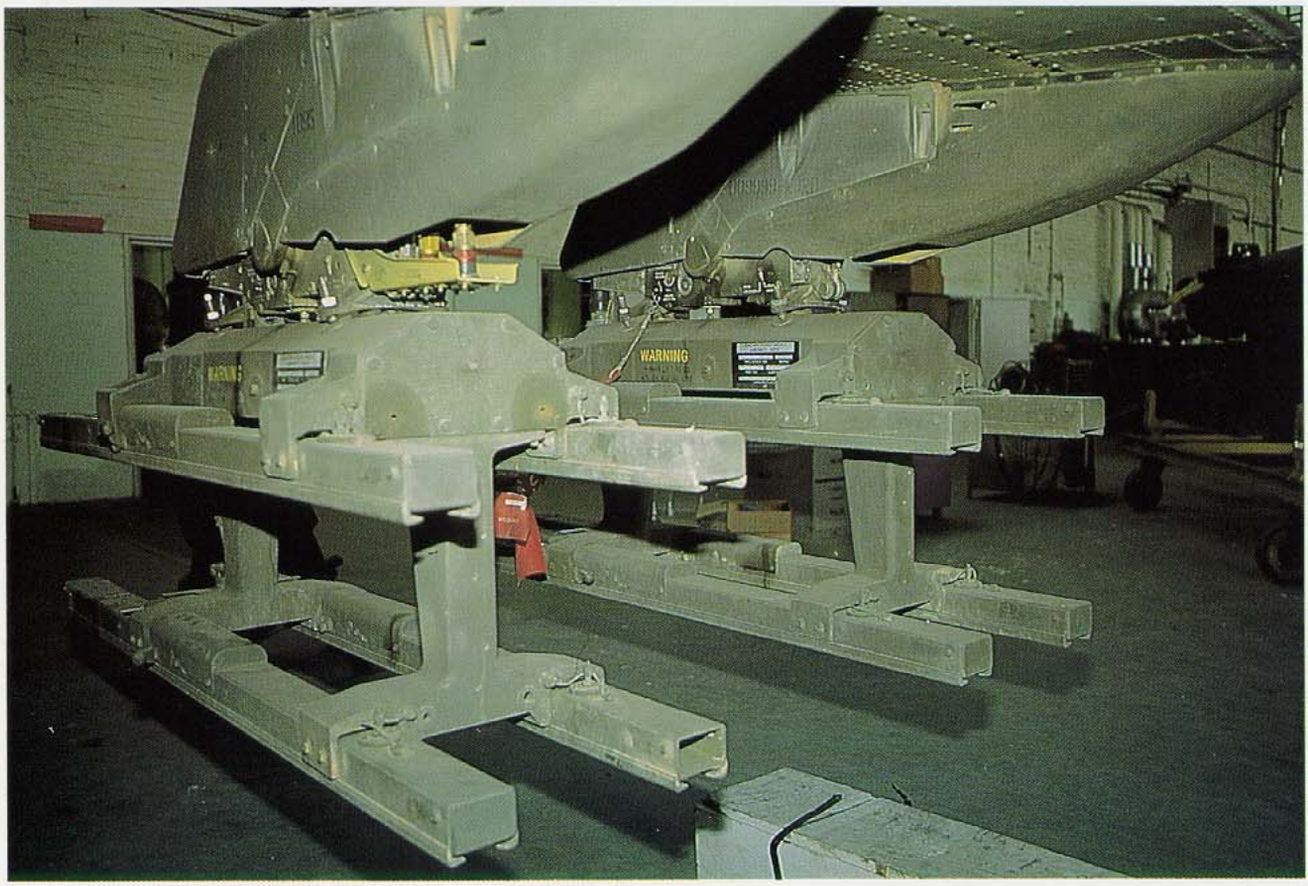
STORES PYLON (EMPTY)

STORES PYLONS PLUS HELLFIRE MISSILE LAUNCHER (LOADED WITH 4 MISSILES)

STORES PYLONS PLUS 19 TUBE ROCKET LAUNCHER (LOADED WITH 19 ROCKETS)

STORES PYLONS PLUS EXTERNAL FUEL TANK

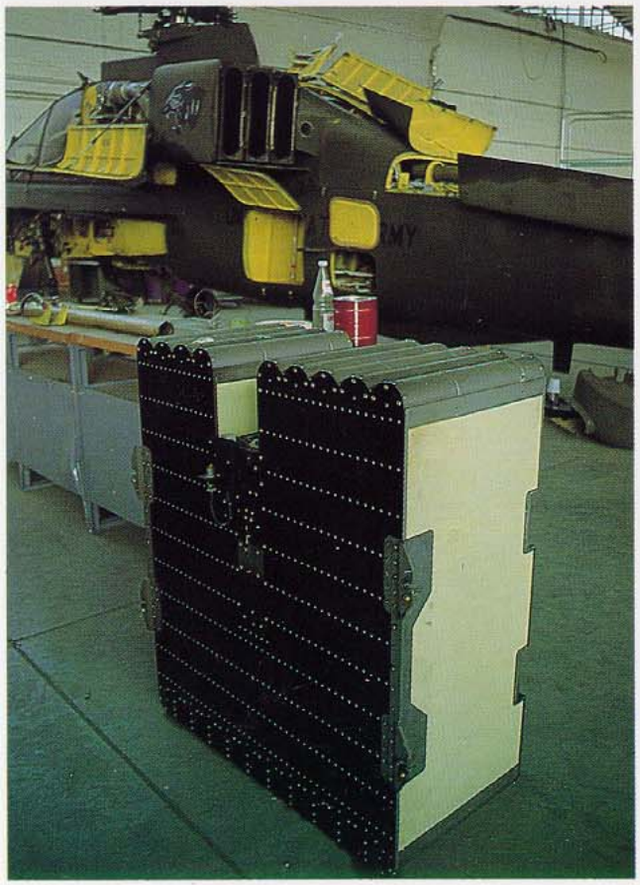
CLEAN STATION

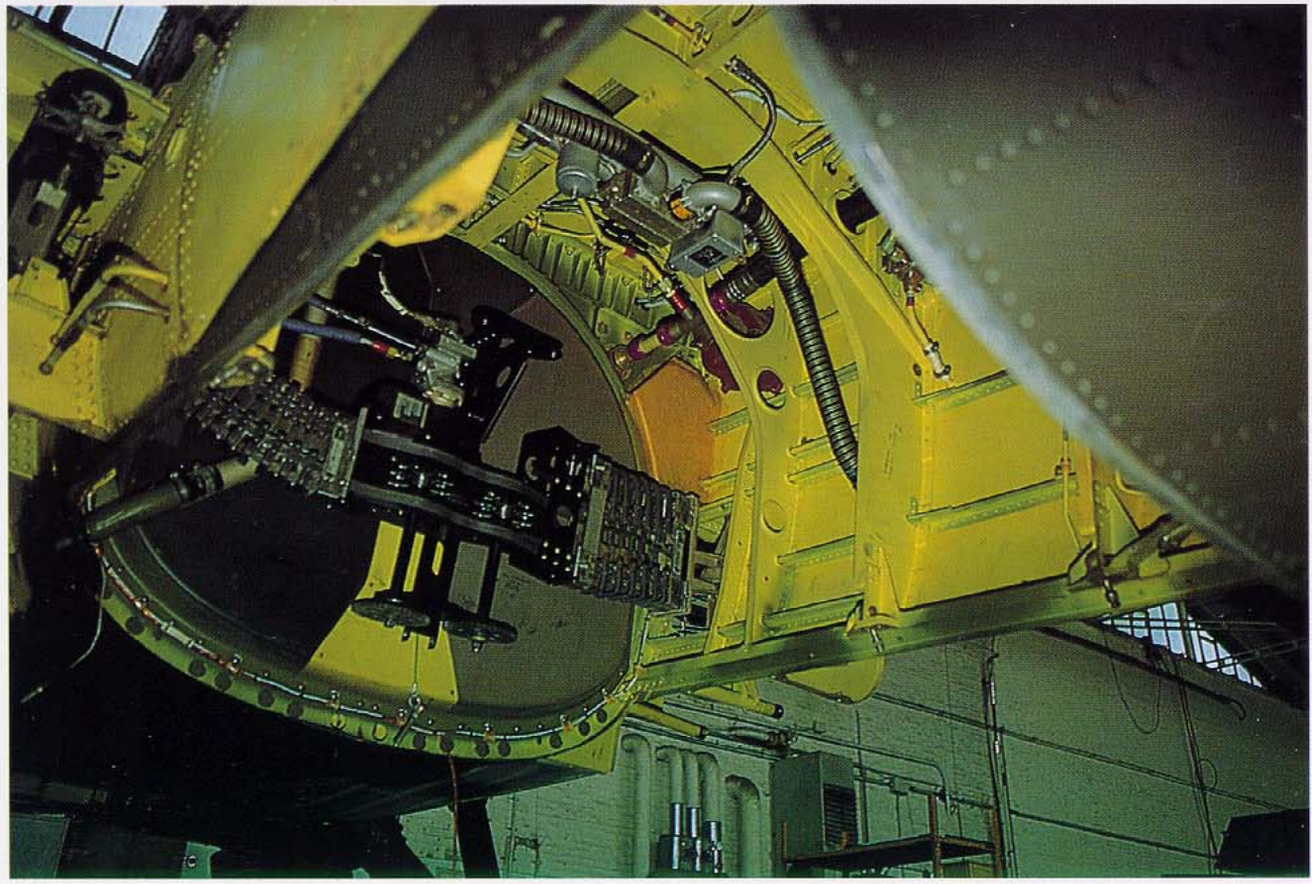


Previous page: Where the fairing housing on the right side can be described as fairly empty, the left side interior has some control boxes attached to the fuselage. Note the bulged canopy glass in the picture at far left. The top center photo reveals the stores control boxes and hardpoint positioning servo, usually covered by an aerodynamic fairing.

This page, right: The forward left avionics bay holds the sight electronics unit (SEU) and display electronics unit (DEU) of the helmet sighting system.

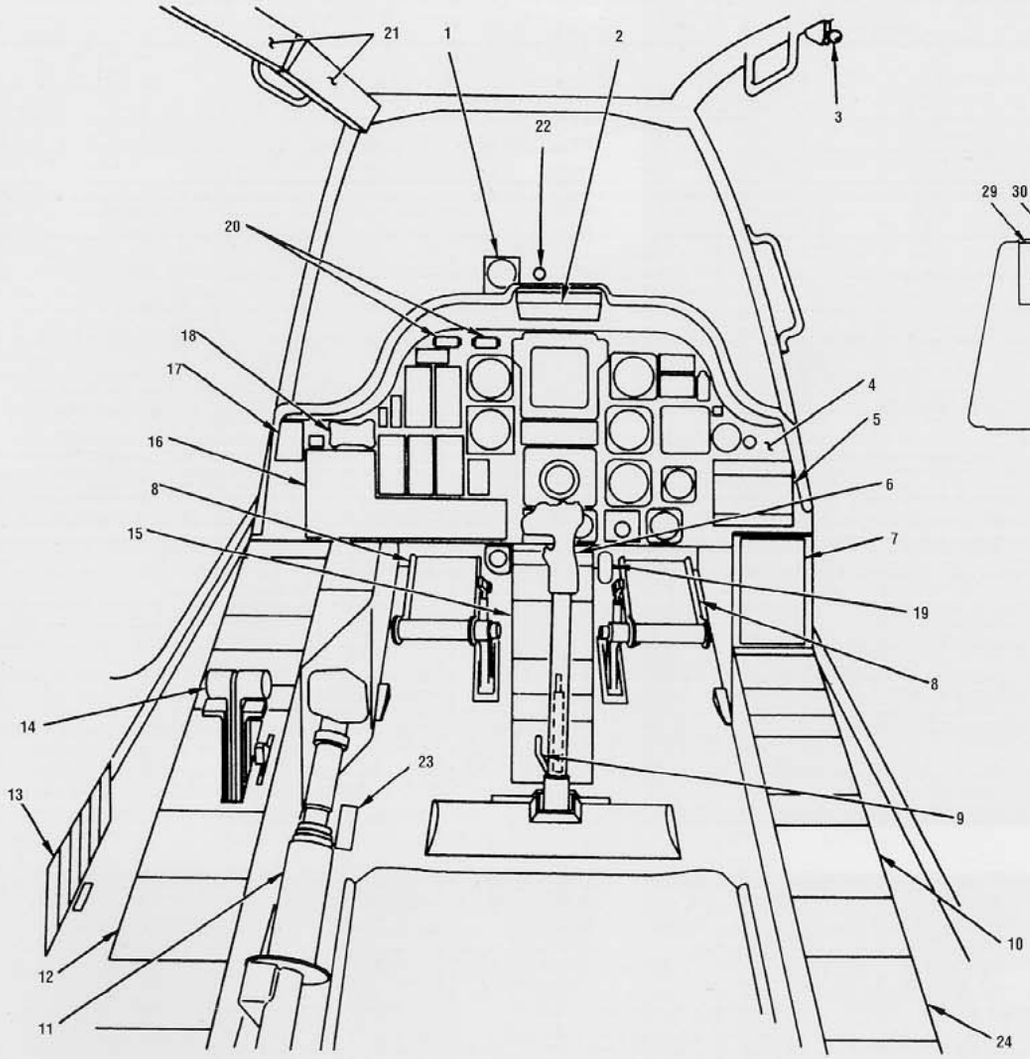
Bottom: A large area of the main airframe is taken by the 1200 round ammunition box shown at left. Once installed, it links up to the ammo feed system seen at the front bulkhead in the bottom right picture. The bottom fuselage cover can be seen on page 20.





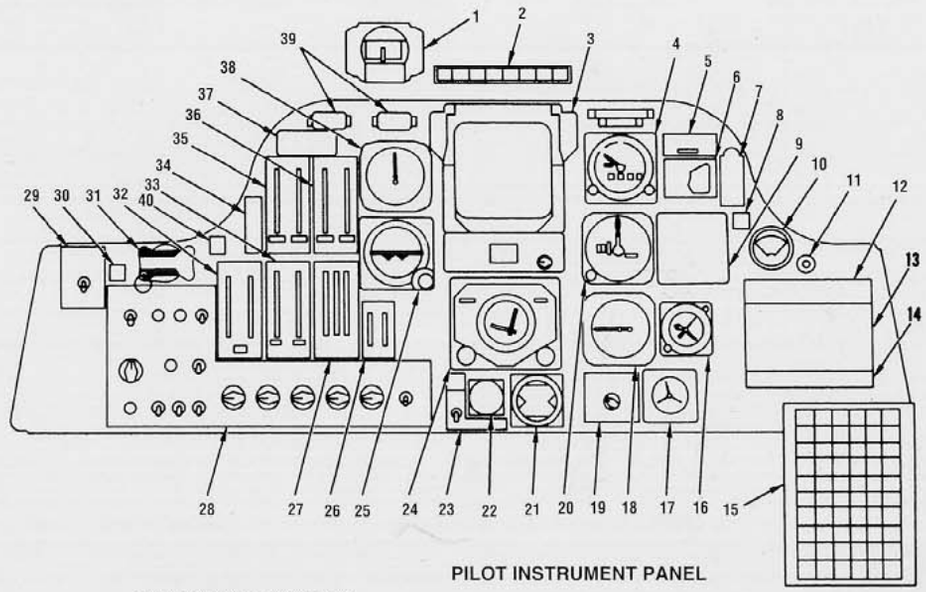
The crew compartments are arranged in tandem and are separated by a ballistic shield preventing fragments of a hit in either cockpit injuring both crewmembers. Entrance of both compartments is from the right side through independently operated canopy covers. The fairing is used as boarding platform. The canopy frame and the transparent ballistic shield form a rollover structure. The windshield consists of two heated laminated glass panels with one directly in front of the CPG and the other directly above his head. The canopy itself consists of five acrylic panels, two on each side of the crew stations and one directly above the pilot. Both crew members are adequately protected by Kevlar armor plating in and around the crew compartments.

To turn a lot of fighter pilots green with envy, the pilot's station in todays helicopter is as complex as that of a sophisticated jet fighter. Simultaneous handling of the collective and cyclic sticks does not facilitate the job.



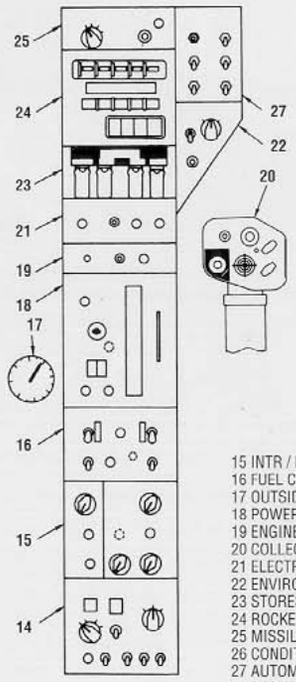
1 STANDBY COMPASS
2 MASTER CAUTION, WARNING PANEL
3 CANOPY DOOR RELEASE
4 INSTRUMENT PANEL
5 CHAFF DISPENSE PANEL
6 CYCLIC STICK
7 CAUTION, WARNING PANEL
8 DIRECTIONAL CONTROL AND BRAKE PEDALS
9 PEDAL ADJUST LEVER
10 RIGHT CONSOLE
11 COLLECTIVE STICK
12 LEFT CONSOLE
13 AUXILIARY AIR VENT
14 POWER LEVERS
15 CENTER CONSOLE
16 FIRE CONTROL PANEL
17 TAIL WHEEL LOCK PANEL
18 CANOPY JETTISON HANDLE
19 PARKING BRAKE HANDLE
20 ENGINE FIRE PULL HANDLES
21 CIRCUIT BREAKER PANELS
22 BORESIGHT RETICLE UNIT
23 STABILATOR MANUAL CONTROL PANEL
24 STOWAGE BOX

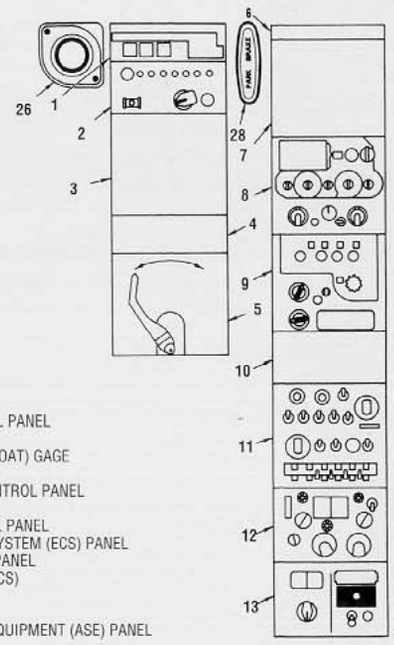
PILOT STATION DIAGRAM



PILOT INSTRUMENT PANEL

1 STANDBY MAGNETIC COMPASS
2 MASTER CAUTION, WARNING PANEL
3 VIDEO DISPLAY UNIT (VDU)
4 RADAR ALTIMETER
5 RADIO CALL PLACARD
6 STABILATOR POSITION INDICATOR
7 STABILATOR / AIRSPEED PLACARD
8 RADAR JAM INDICATOR
9 RADAR WARNING DISPLAY
10 ICING SEVERITY METER
11 PRESS-TO-TEST SWITCH
12 IR RADAR CONTROL
13 CHAFF DISPENSE PANEL
14 RADAR WARNING PANEL
15 CAUTION, WARNING PANEL
16 CLOCK
17 ACCELEROMETER
18 INSTANTANEOUS VERTICAL SPEED INDICATOR (IVSI)
19 HARS ALIGNMENTS SWITCH
20 BAROMETRIC ALTIMETER
21 HYDRAULIC PRESSURE GAGE
22 UTILITY ACCUMULATOR PRESSURE GAUGE
23 EMERGENCY HYDRAULIC PRESSURE SWITCH
24 HORIZONTAL SITUATION INDICATOR (HSI)
25 STANDBY ATTITUDE INDICATOR
26 ENGINE OIL PRESSURE INDICATOR
27 ENGINE (Np), ROTOR (N_R) INDICATOR
28 FIRE CONTROL PANEL
29 TAIL WHEEL LOCK CONTROL PANEL
30 ARM SAFE INDICATOR
31 CANOPY JETTISON HANDLE
32 FUEL QUANTITY INDICATOR
33 ENGINE GAS GENERATOR (N_G) INDICATOR
34 INSTRUMENT DIM / TEST PANEL
35 ENGINE TURBINE GAS TEMPERATURE (TGT) INDICATOR
36 ENGINE TORQUE INDICATOR
37 FIRE EXTINGUISHER BOTTLE SELECT SWITCH
38 AIRSPEED INDICATOR
39 ENGINE FIRE PULL HANDLES
40 FUEL TRANSFER INDICATOR





PILOT CONTROL CONSOLES

1 REMOTE TRANSMITTER SELECTOR PANEL
2 C-10414/ARC COMM SYSTEM CONTROL PANEL
3 BLANK PANEL
4 BLANK PANEL
5 DIRECTIONAL PEDAL ADJUSTMENT CONTROL
6 BLANK PANEL
7 TSEC / KY-58 SECURE VOICE CONTROL (PROVISIONS)
8 TR1167 / ARC - 164 UHF-AM RADIO CONTROL PANEL
9 AN / ARC - 186 VHF-FM-AM RADIO CONTROL PANEL
10 TSEC / KY-28 SECURE VOICE CONTROL (PROVISIONS)
11 AN / A PX-100 IFF TRANSPONDER CONTROL PANEL
12 C-73924 / ARN-89B ADF CONTROL PANEL
13 APU / FIRE TEST PANEL
14 ANTI-ICE CONTROL PANEL
15 INTR / EXT LICHTING CONTROL PANEL
16 FUEL CONTROL PANEL
17 OUTSIDE AIR TEMPERATURE (OAT) GAGE
18 POWER LEVER QUADRANT
19 ENGINE OVERSPEED TEST CONTROL PANEL
20 COLLECTIVE SWITCH BOX
21 ELECTRICAL POWER CONTROL PANEL
22 ENVIRONMENTAL CONTROL SYSTEM (ECS) PANEL
23 STORES JETTISON CONTROL PANEL
24 ROCKET CONTROL PANEL (ARCS)
25 MISSILE CONTROL PANEL
26 CONDITIONED AIR OUTLET
27 AUTOMATIC STABILIZATION EQUIPMENT (ASE) PANEL
28 PARKING BRAKE

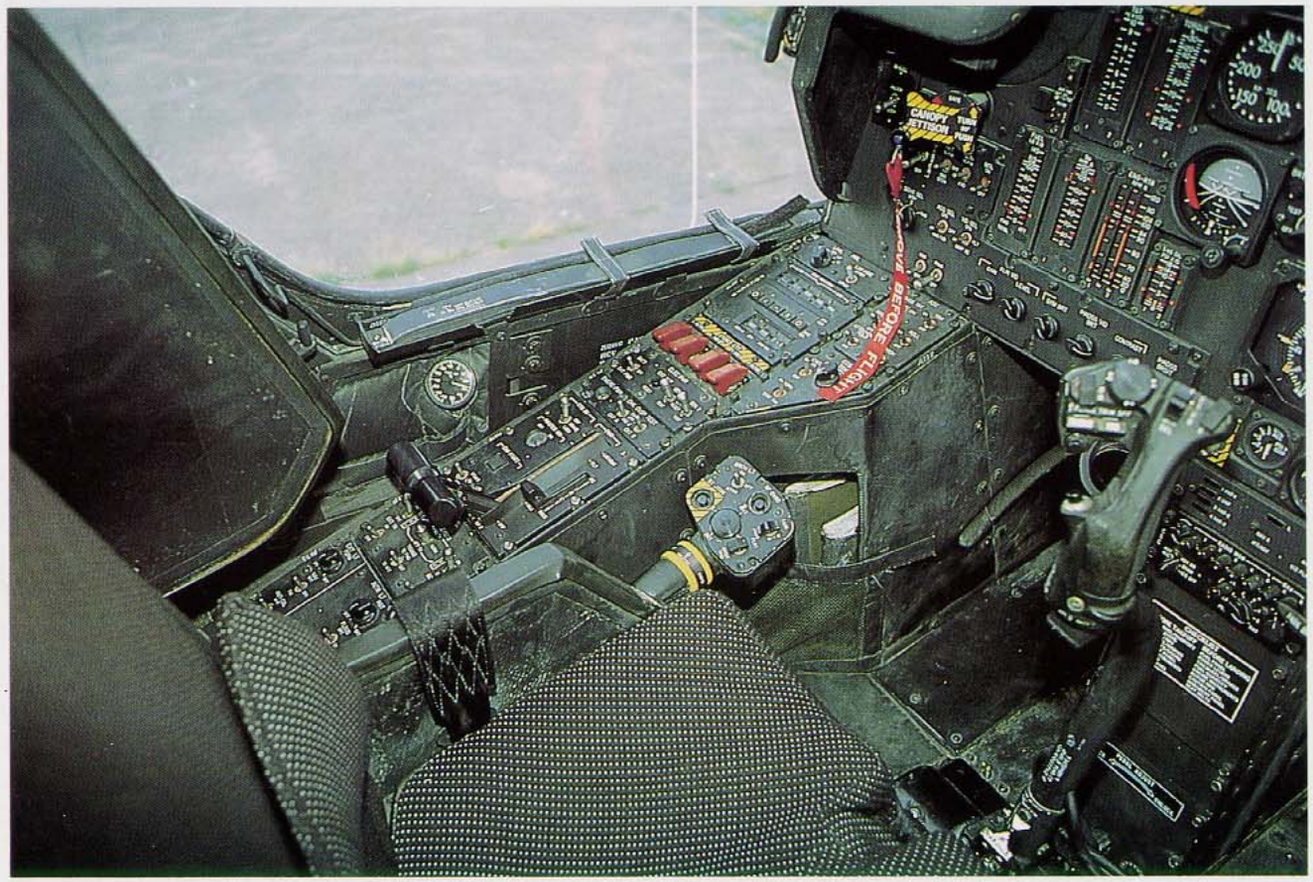
(COURTESY U.S. ARMY)

The flight control system consists of mechanical flight controls, digital automatic stabilization equipment, and an automatically or manually controlled stabilator. The mechanical flight controls provide a cyclic stick, collective stick and directional pedals in each crew station, connected in tandem, to control main and tail rotor hydraulic servo actuators.

The cyclic stick provides for helicopter movement about the pitch and roll axes. The CPG stick has a lockpin release mechanism at the base of the stick, allowing the stick to be folded while viewing the headsdown display (the cyclic stick remains functional in this position).

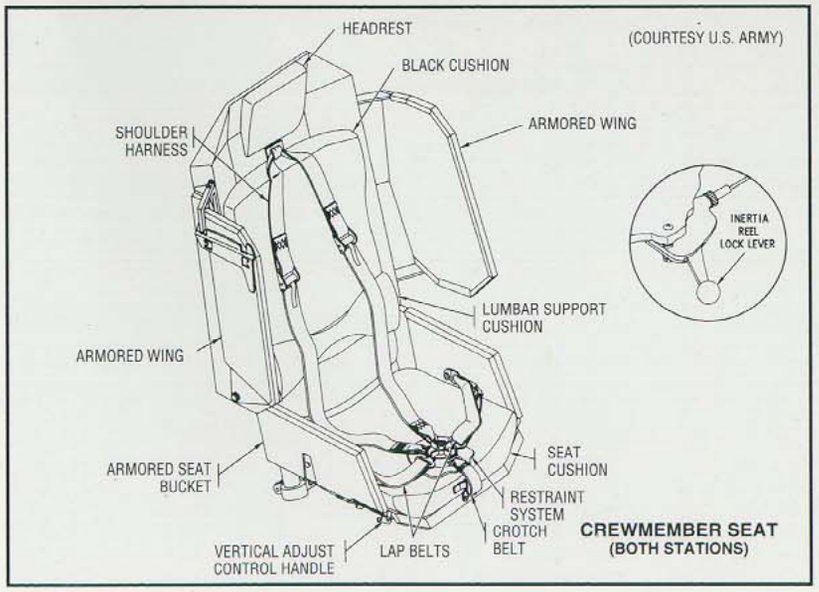
The collective stick adjusts pitch angle of the main rotor blade and fuel flow metering requirements of the gas generator turbine. Each stick has an engine chop collar to permit both engines to be reduced to idle without moving the power levers.

Finally, the directional controls pedals provide for helicopter movement about the yaw axis.

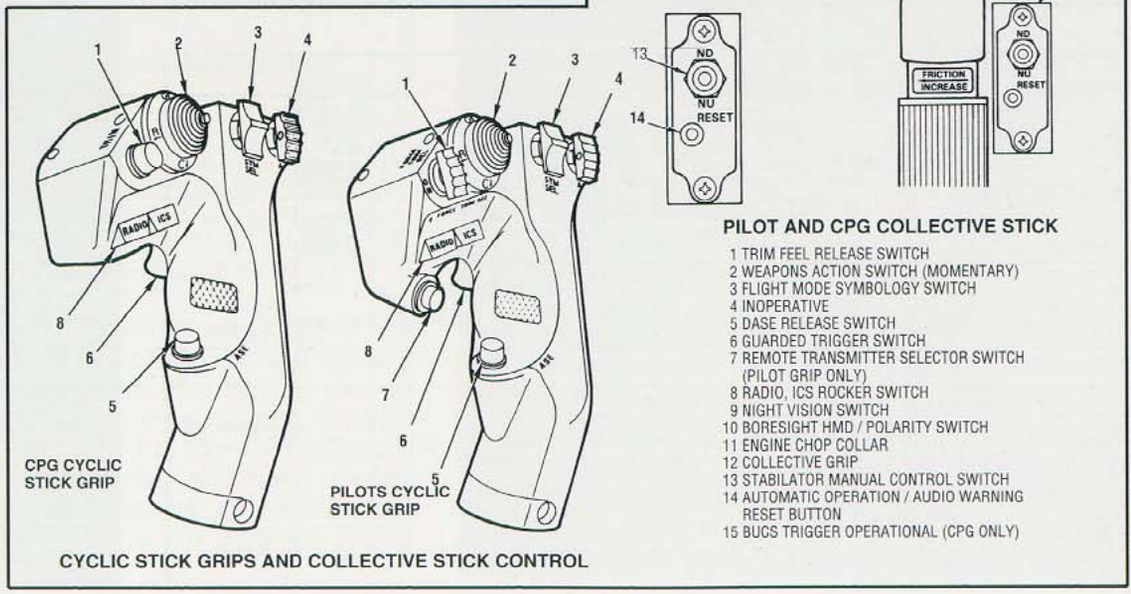


Above: The pilot's circuit breaker panel, located overhead on the left in the rear cockpit.

Left: Both seats provide ballistic protection and can be adjusted for height only. They are one-piece armored seats equipped with back, seat, and lumbar support cushions and shoulder harness, lap belt, crotch belt and inertia reel.



CREWMEMBER SEAT (BOTH STATIONS)

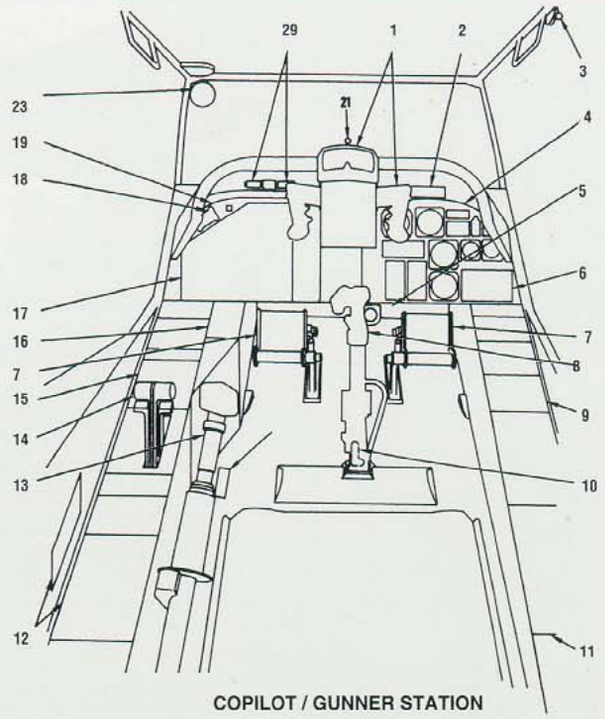


CYCLIC STICK GRIPS AND COLLECTIVE STICK CONTROL

PILOT AND CPG COLLECTIVE STICK

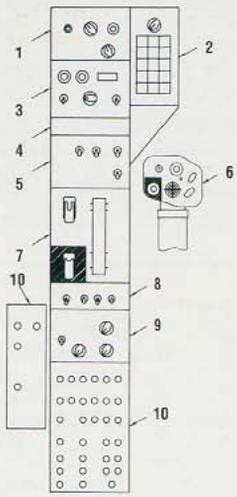
1 TRIM FEEL RELEASE SWITCH
2 WEAPONS ACTION SWITCH (MOMENTARY)
3 FLIGHT MODE SYMBOLOGY SWITCH
4 INOPERATIVE
5 DASE RELEASE SWITCH
6 GUARDED TRIGGER SWITCH
7 REMOTE TRANSMITTER SELECTOR SWITCH (PILOT GRIP ONLY)
8 RADIO, ICS ROCKER SWITCH
9 NIGHT VISION SWITCH
10 BORESIGHT HMD / POLARITY SWITCH
11 ENGINE CHOP COLLAR
12 COLLECTIVE GRIP
13 STABILATOR MANUAL CONTROL SWITCH
14 AUTOMATIC OPERATION / AUDIO WARNING RESET BUTTON
15 BUCS TRIGGER OPERATIONAL (CPG ONLY)

1 OFFICIAL RELAY TUBE AND HANDGRIPS
2 MASTER CAUTION AND WARNING PANEL
3 CANOPY DOOR RELEASE
4 RIGHT INSTRUMENT PANEL
5 CONDITIONED AIR OUTLET
6 CAUTION / WARNING PANEL
7 DIRECTIONAL CONTROL AND BRAKE PEDALS
8 CYCLIC STICK
9 RIGHT CONSOLE
10 PEDAL ADJUST LEVER
11 MAP STORAGE COMPARTMENT
12 CIRCUIT BREAKER PANELS
13 COLLECTIVE STICK
14 POWER LEVERS
15 LEFT CONSOLE
16 DATA ENTRY KEYBOARD
17 FIRE CONTROL PANEL
18 CANOPY JETTISON HANDLE
19 LEFT INSTRUMENT PANEL
20 ENGINE FIRE PULL HANDLES
21 BORESIGHT RETICLE UNIT
22 STABILATOR MANUAL CONTROL PANEL
23 MIRROR



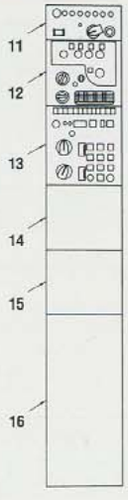
(COURTESY U.S. ARMY)

COPILOT / GUNNER STATION

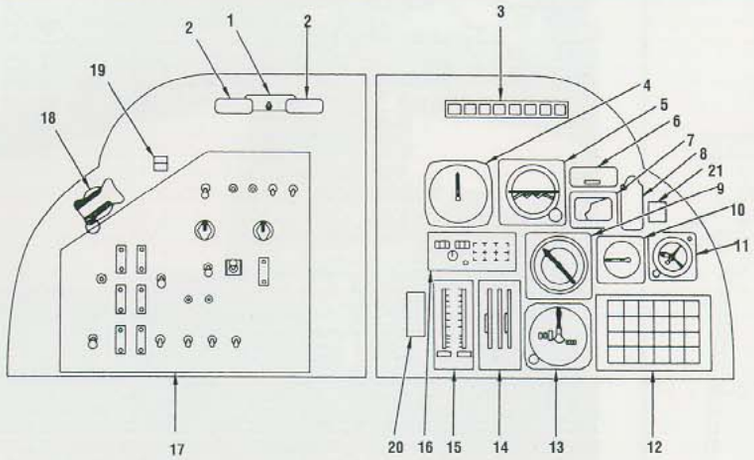


1 MISSILE CONTROL PANEL
2 DATA ENTRY KEYBORD
3 RECORDER CONTROL PANEL
4 BLANK
5 AUX CONTROL PANEL
6 COLLECTIVE SWITCH BOX
7 POWER LEVER QUADRANT
8 FUEL CONTROL PANEL
9 INTERIOR LIGHTING CONTROL PANEL
10 CIRCUIT BREAKERS PANELS
11 C-10414 / ARC COMMUNICATIONS SYSTEM CONTROL PANEL
12 AN / ARC-186 VHF-FM-AM RADIO CONTROL PANEL
13 AN / ASN - 128 DOPPLER CONTROL PANEL
14 TSEC / KY-58 SECURE VOICE CONTROL (PROVISIONS)
15 BLANK
16 MAP STOWAGE

(COURTESY U.S. ARMY)

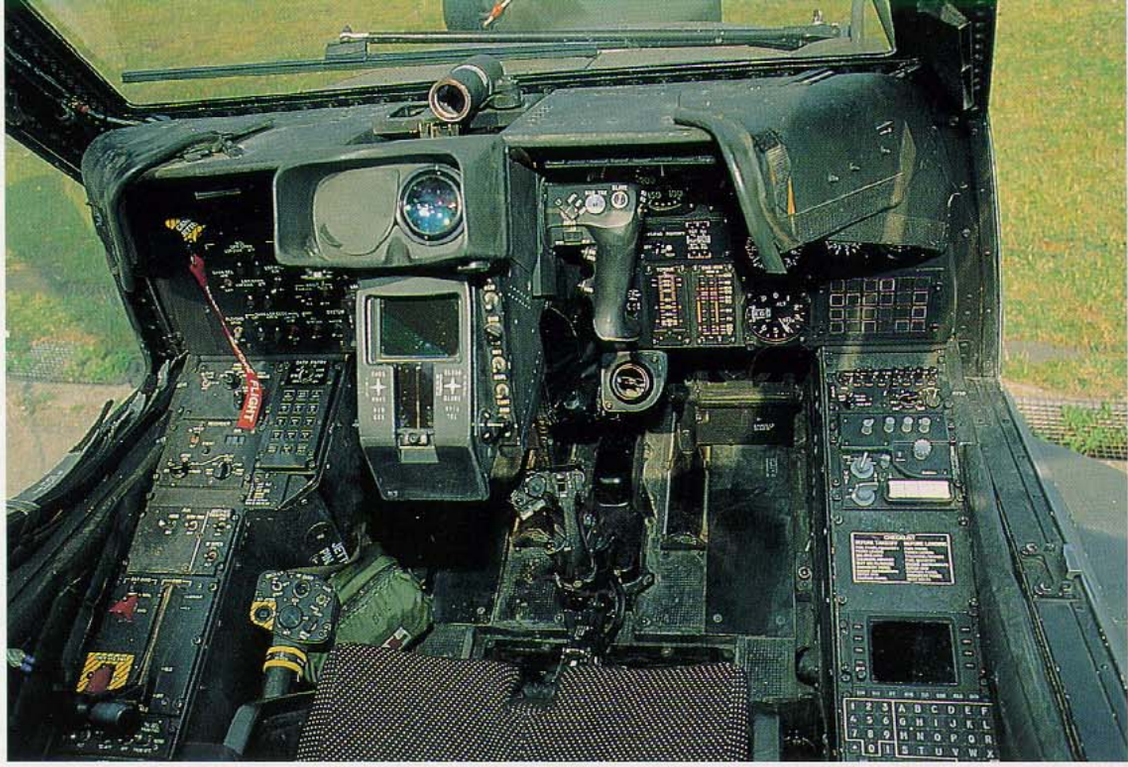


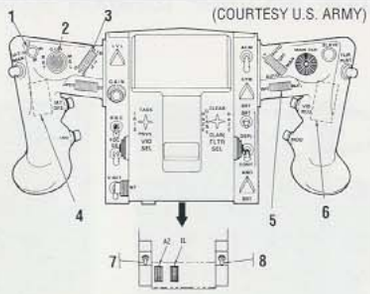
CPG SIDE CONSOLES



1 FIRE EXTINGUISHER BOTTLE SELECT SWITCH
2 ENGINE FIRE PULL HANDLES
3 MASTER CAUTION, WARNING PANEL
4 AIRSPEED INDICATOR
5 REMOTE ATTITUDE INDICATOR
6 RADIO CALL PLACARD
7 STABILATOR POSITION INDICATOR
8 STABILATOR / AIRSPEED PLACARD
9 RADIO MAGNETIC INDICATOR (RMI)
10 INSTANTANEOUS VERTICAL SPEED INDICATOR (IVSI)
11 CLOCK
12 CAUTION / WARNING PANEL
13 BAROMETRIC ALTIMETER
14 ENGINE (N_P), ROTOR (N_R) INDICATOR
15 ENGINE TORQUE INDICATOR
16 SELECTABLE DIGITAL DISPLAY PANEL
17 FIRE CONTROL PANEL
18 CANOPY JETTISON HANDLE
19 ARM SAVE INDICATOR
20 ENGINE INSTRUMENT DIM / TEST PANEL
21 FUEL TRANSFER INDICATOR

CPG MAIN INSTRUMENT PANEL (COURTESY U.S. ARMY)



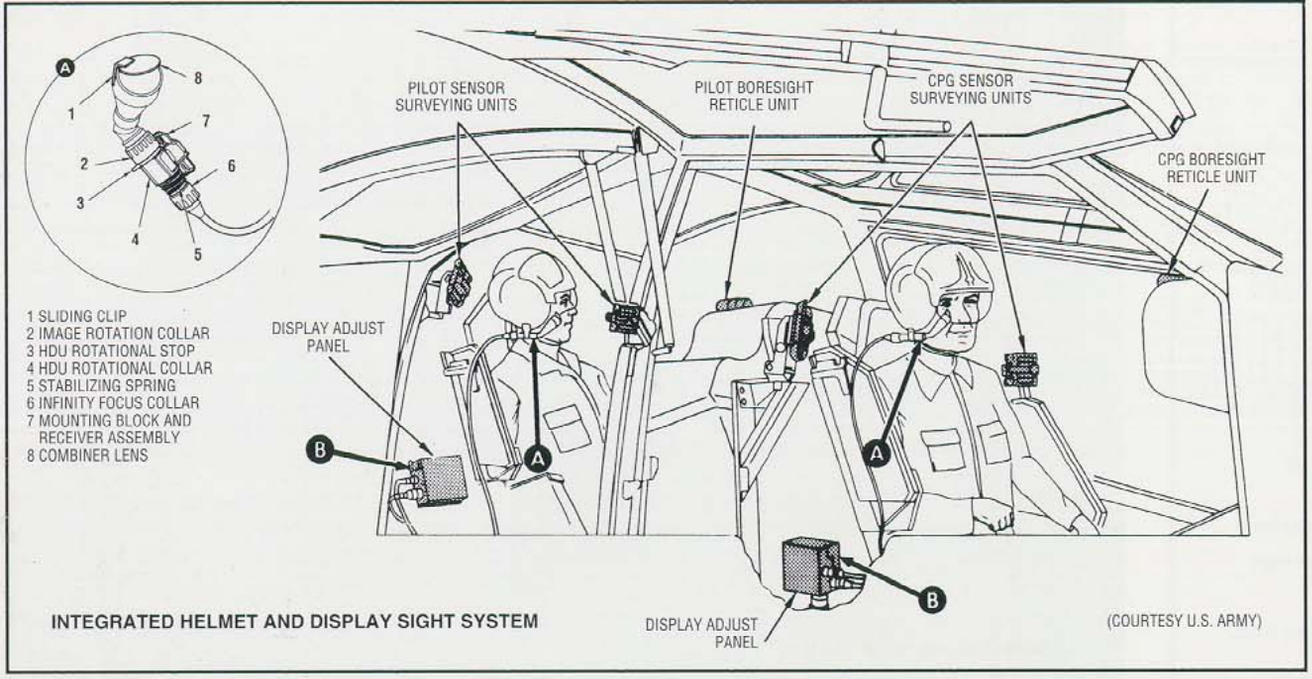


(COURTESY U.S. ARMY)

1 FIELD OF VIEW SELECT SWITCH
2 WEAPONS ACTION SWITCH (WAS)
3 SENSOR SELECT SWITCH
4 WEAPONS TRIGGER
5 IMAGE-AUTOTRACKER POLARITY SWITCH
6 LRF/D TRIGGER
7 BORESIGHT ENABLE
8 DVO ADJUST

ORT AND HAND CONTROLS

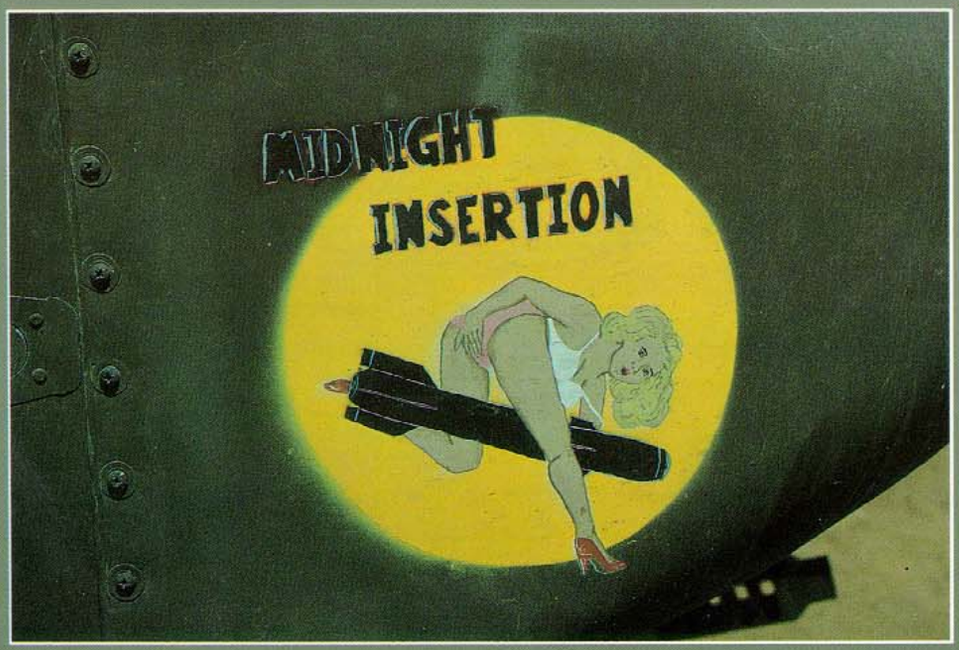
Photographic coverage of the CPG (Copilot Gunner) station which has the busiest job on board when engaged. Centrally located is the ORT (Optical Relay Tube) and hand control column which receives power as part of the overall TADS system.



INTEGRATED HELMET AND DISPLAY SIGHT SYSTEM (COURTESY U.S. ARMY)

The APACHE is fitted with an Integrated Helmet and Display Sight Subsystem (IHADSS) which consists of a crew member helmet, a helmet display unit (HDU), sensor survey unit (SSU) and the units in the forward left avionics bay. This system together with a skilled crew (and aren't they all ?) makes the APACHE one of the deadliest and most accurate weapon systems on todays battlefields.

(Photo Jules TOSCHI)



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